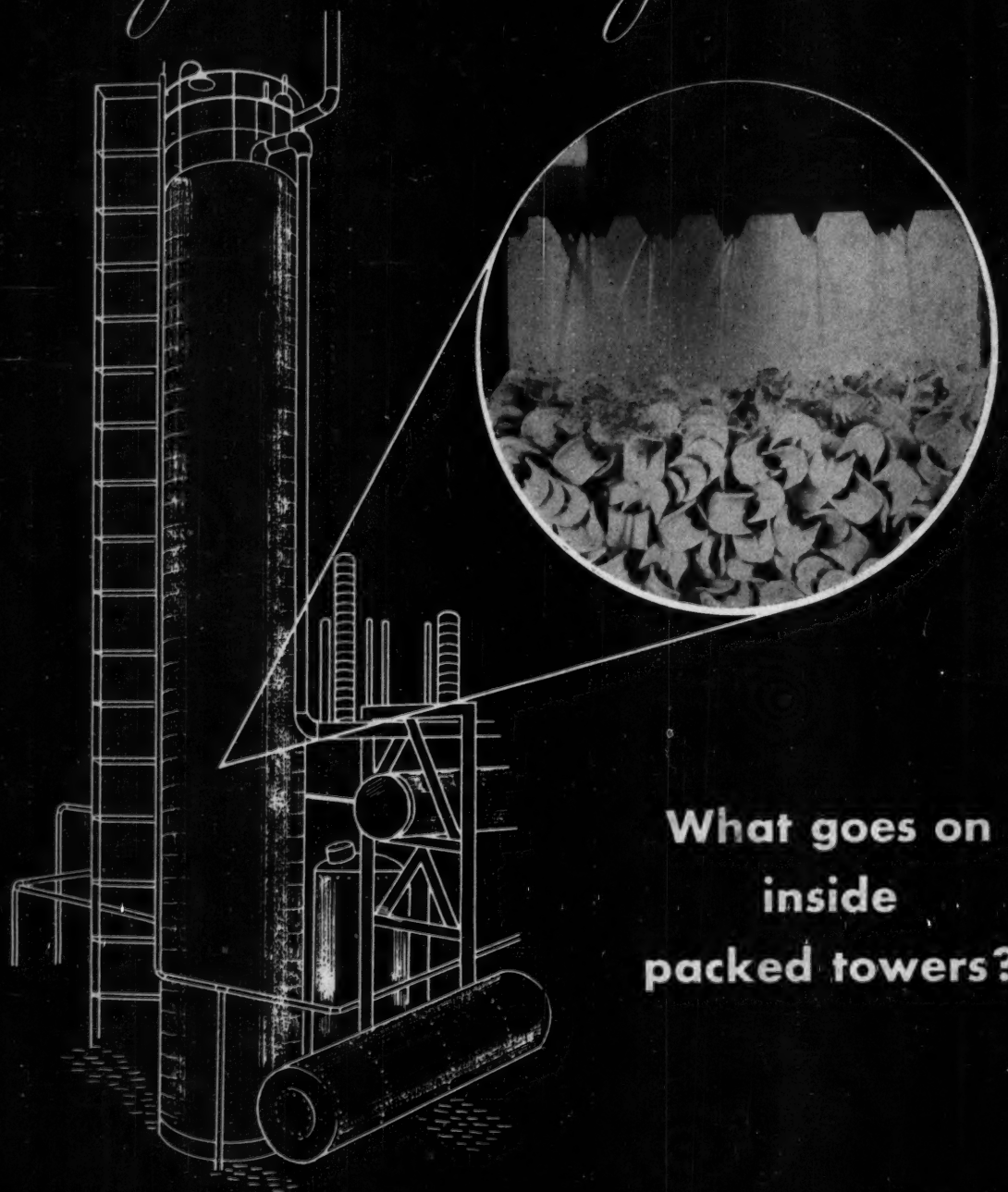
Chemical Engineering

AUGUST
1953



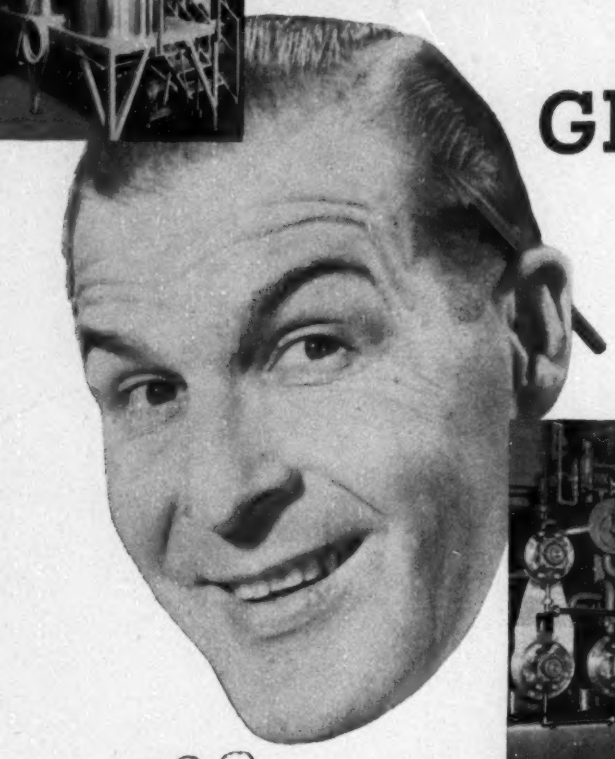
What goes on inside packed towers?

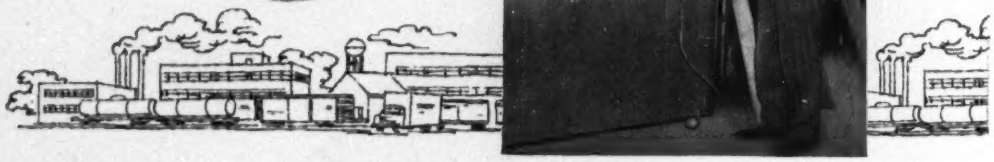
A McGRAW-HILL PUBLICATION

ONE DOLLAR

This salad dressing process plant of Durkee Famous Foods Division of the Glidden Company was engineered and built by the Votator Division of Girdler.

THIS IS GIRDLER





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GIRDLER MANUFACTURES VOTATOR* Heat Transfer Apparatus for continuous heating, cooling, crystallizing, sterilizing and aerating a wide variety of food and chemical products. We take responsibility for design and construction of your process facilities, and turn over to you a plant in operation. When you plan process plant construction or modernization, use Girdler's complete service. Call the nearest Girdler office.

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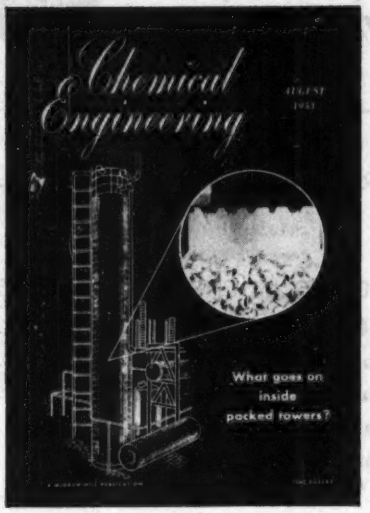

. . . What every chemical engineer should know about packed towers.

Packed towers aren't used in plants as much as they should be. The reasons, says Hydrocarbon Research's Fred Zenz: Not enough reliable design data, uncertain results.

Zenz takes a hard look at the latest thinking in the field—pressure drop curves, flooding points, gas- and liquid-continuous ranges, degree of wetting, design features.

He comes up with this interpretive article that'll give you a better grasp of the why's and how's of packed towers and their operation (*Feature Article*).

How to pick the right materials.

It's not easy to select corrosion-resistant materials for chemical equipment. Here's a comprehensive guide that may save you headaches later on (*Feature Article*).

A cooling pond may be your answer.

You may be surprised at some of the water cooling problems a well-designed

Please turn page

Next Month: Your Refresher

Ever wish there were some sort of easy, painless way you could keep up-to-date and "refreshed" on the principles of chemical engineering and how to put them to better use?

We've now got exactly what you want: A continuing, down-to-earth, easy-to-read "refresher textbook."

For next month we'll start a brand-new monthly series of chemical engineering refresher articles. We'll begin with a series on thermodynamics and thermochemistry—then go on to compression and expansion, to chemical kinetics, and so on. The entire "course" will run for 18 months or more.

Author is Thomas E. Corrigan, a young engineer with broad teaching and industrial experience. He's now with Mathieson Chemical Corp.

You'll find Corrigan's "refresher" series refreshingly lucid—yet authoritative and practical. It will give you a better grasp of the fundamentals of chemical engineering, what they mean and how they tie together.

Watch for the first of Corrigan's "refreshers." That's next month.

Chemical Engineering
AUGUST 1953

GUIDED TOUR

pond can solve. Author Langhaar points out advantages, gives new and useful design charts (*Feature Article*).

Watch those hidden packaging costs.

There's more to packaging than appears on the cost sheet. A wrong choice of materials can multiply your dollar losses beyond all reason. Here's practical information on how (*Feature Article*).

What's happening on four new fronts.

First phenol-from-cumene plant goes on stream near Montreal, uses new oxidation-cleavage process. . . .

Ingenious nitrophosphate plant stabilizes nitrate with CO_2, avoids phosphate reversion. First U. S. plant to use the process scheduled to be built soon. . . .

Hydroxylation—a new unit process—is now used in New Jersey to turn fats and oils into vinyl plasticizers. . . .

New, continuous process turns out resin-bonded fiberboard as a 4-ft. wide endless sheet (*What's Happening*),

Rejoin GUIDED TOUR page 249

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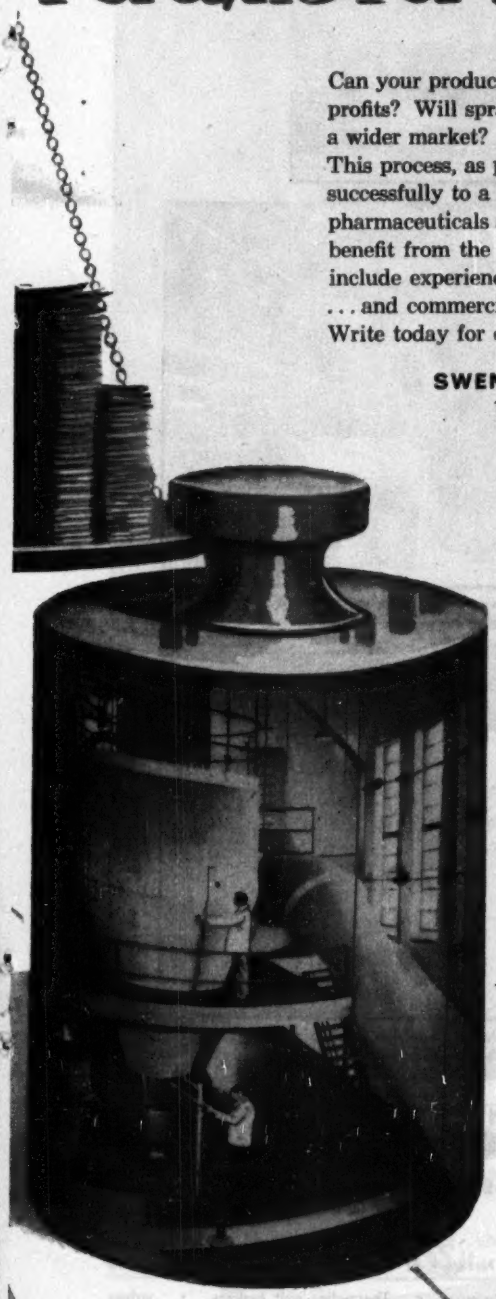

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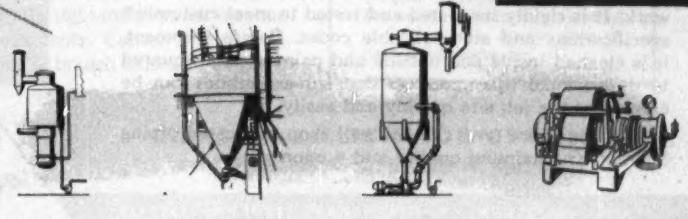

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Part of the welding floor at Grinnell's Warren, Ohio Plant

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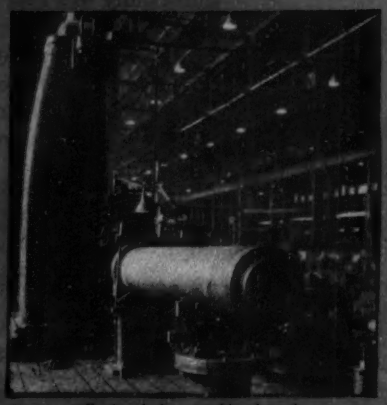

Heavy-wall pipe being machined to the proper welding bevel on a pipe mill

Welding (induction heating coils in place for preheat, welding heat and stress relieving.)

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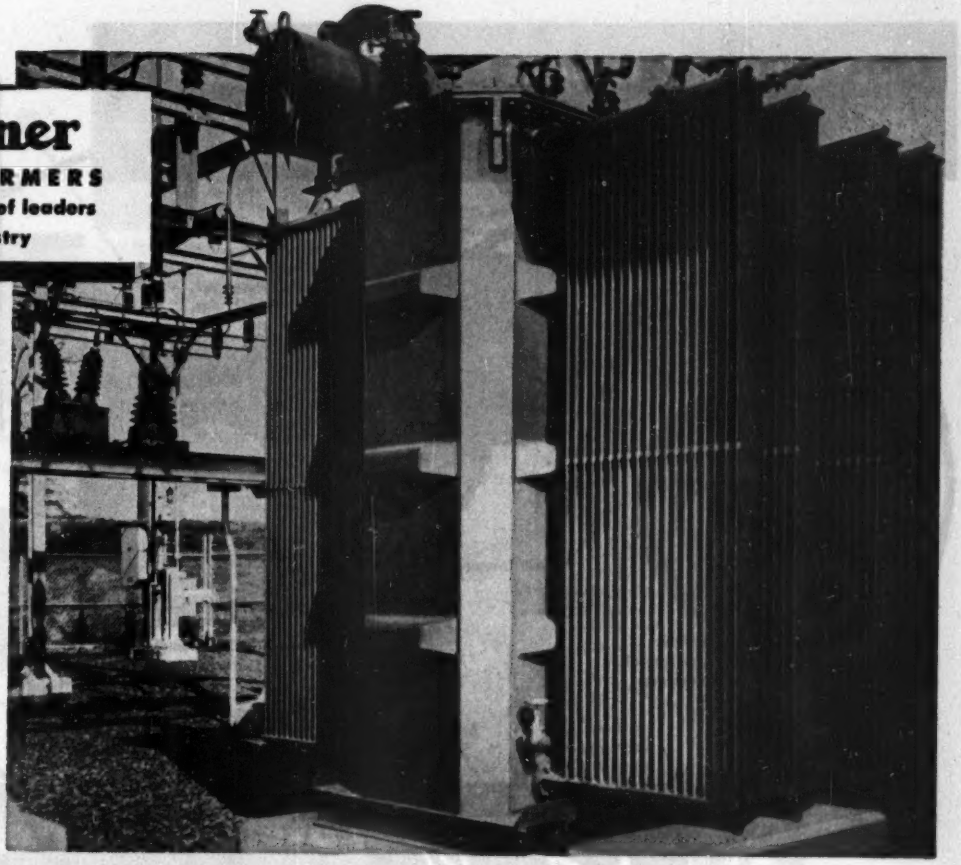

to help make good foods better...

The Vitamin Division of Hoffmann-LaRoche, Inc., at Nutley, New Jersey helps food processors "keep faith with nature." It produces ascorbic acid that protects processed foods from loss of natural color and flavor and adds to their nutritional value. It produces vitamins for the enrichment of bread, cereals, and other grain foods.

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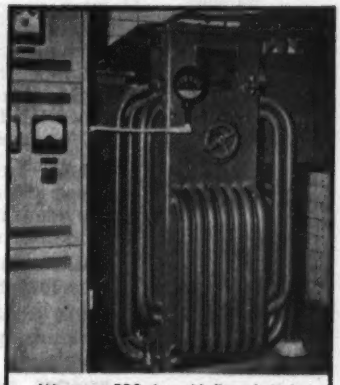

Wagner 500 kva Noflamol Unit Substation Transformer installed at Nutley, New Jersey plant of Hoffmann-LaRoche, Inc.

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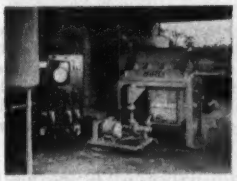
The Center's main test floor

The Bird Screen Type Centrifugal Filter

The mezzanine, showing feed and filtrate tanks

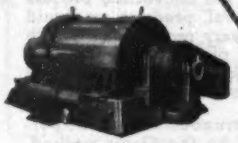
The Bird-Young Continuous Vacuum Filter with pneumatic removal of filter cake



The test area for hazardous or volatile materials

The Bird Suspended Centrifugal for heavy duty, high capacity batch centrifuging

The analytical laboratory



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☐ **AUXILIARY RELAYS.** Multiplying, dividing, adding, subtracting, maximum and minimum setting, ratio, ratio computing, sequential, splitter, squaring, square root extracting, and position indicating.

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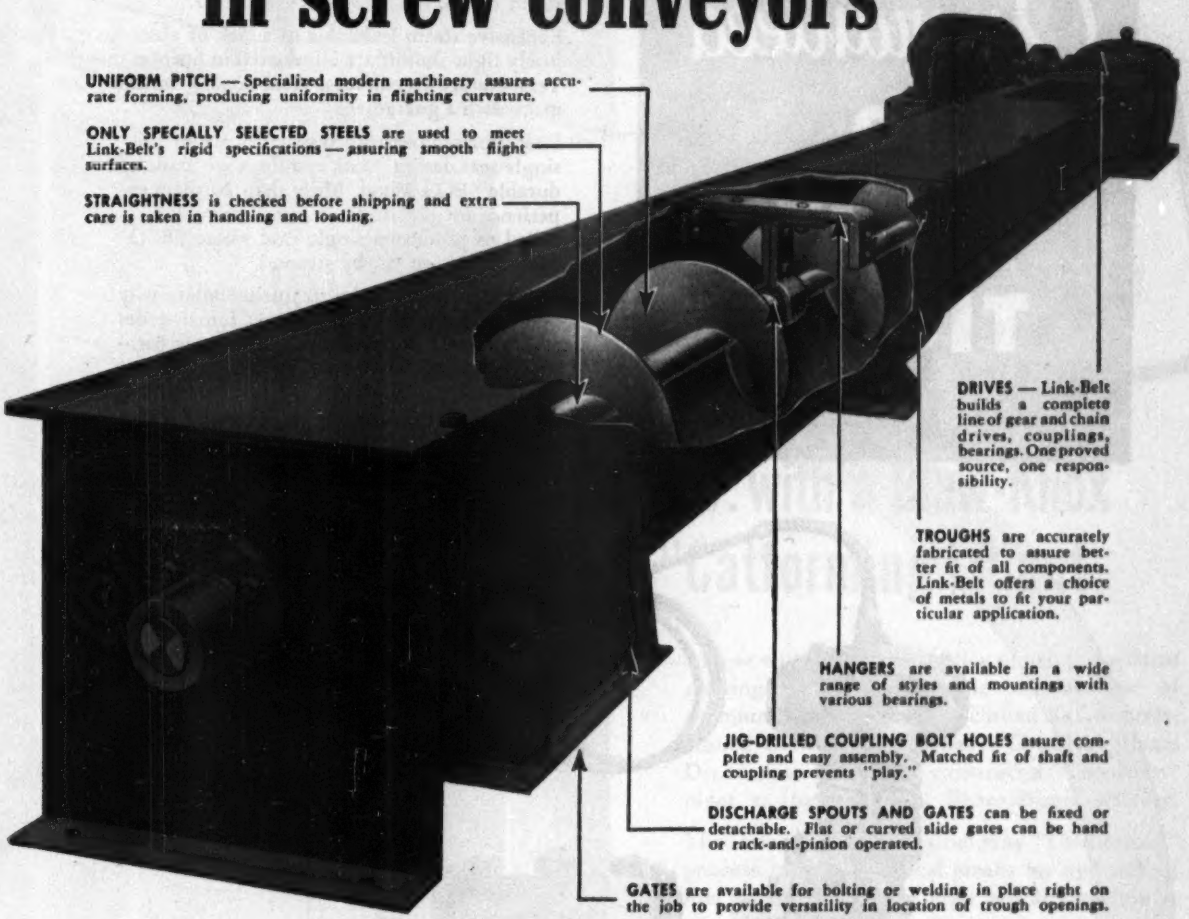
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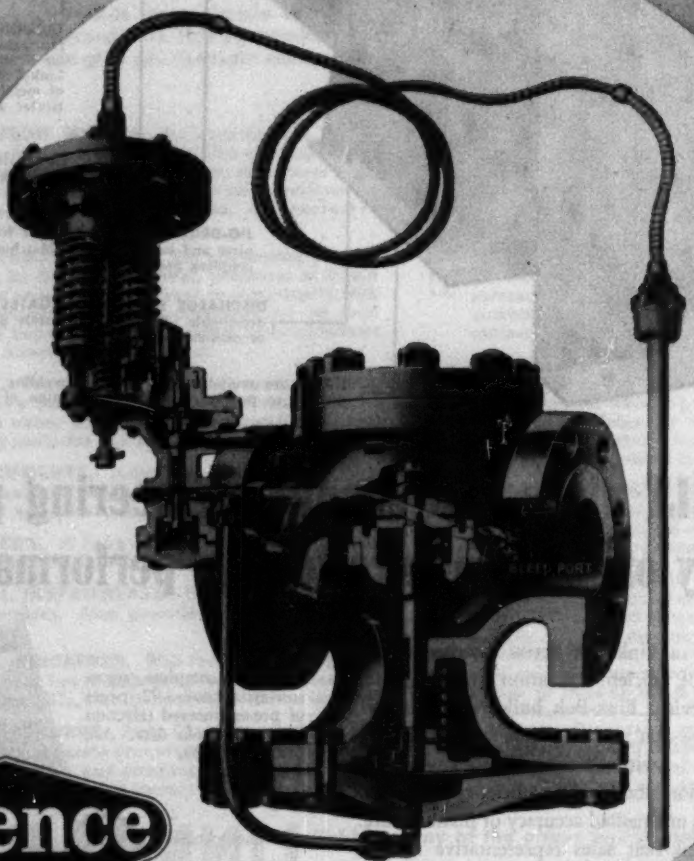

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Temperature
Regulator

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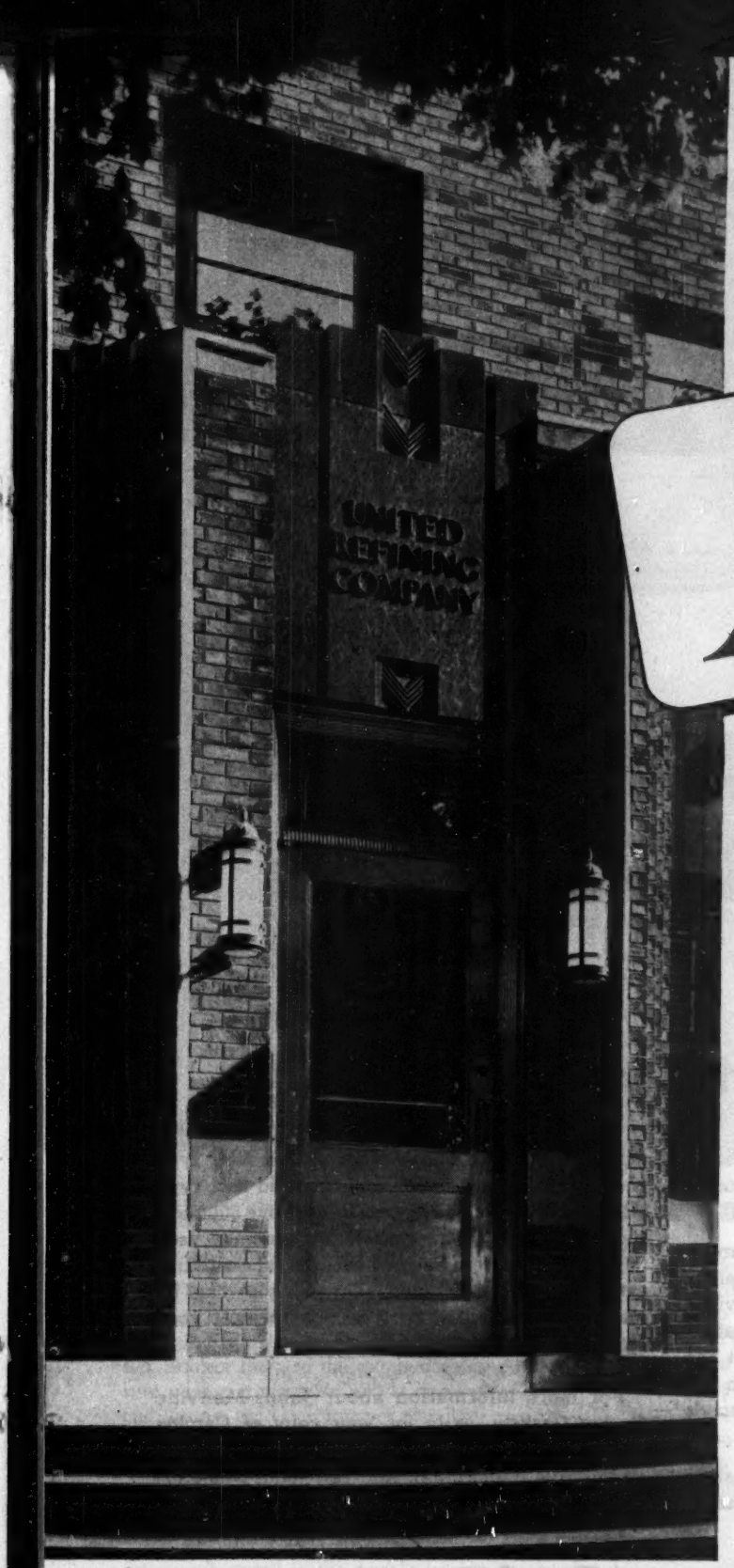
SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK



UNITED REFINING COMPANY marks its

50th Anniversary

...with a Blaw-Knox "Catforming" Plant

In line with its 50-year policy of using the latest refining techniques in the manufacture of premium quality products, United has commissioned Blaw-Knox Company, Chemical Plants Division, to design and construct a "Catformer" plant at their Warren, Pennsylvania refinery.

The Atlantic Refining Company "Catforming" process is an economical means for up-grading low grade naphthas to high octane gasoline at 95-100 per cent yield. The catalyst is selective and rugged; the yield-octane relationships are well established by pilot plant evaluation of numerous stocks; and commercial operations have confirmed basic design features.

Chemical Plants Division is licensed to offer Atlantic's "Catforming" process and would be pleased to discuss product yields and qualities, plant investment and operating costs with you. "Catforming" offers an economically attractive solution to your octane problem.

BLAW-KNOX COMPANY
CHEMICAL PLANTS DIVISION
TULSA 1, OKLAHOMA
Chicago 1
New York 17
Pittsburgh 22

BLAW-KNOX

H.P. pipe gaskets like these *made to your order* by gasket specialists...

...to save you both time and money

When you need metallic gaskets for high pressure piping, put the job up to Johns-Manville Goetze Gasket specialists. You benefit in many ways:

You get the exact gaskets you need for maximum efficiency under *your* operating conditions, tailor-made to fit *your* equipment. You get the savings in cost made possible by intensive specialization and modern production tooling. And you get the full benefit of over sixty years' experience in designing specialized metallic gaskets for industry's most complex sealing requirements.

Typical styles of Johns-Manville Goetze Gaskets that have been made to order for high pressure piping service are shown above. The flare type gasket with bellows action and the solid flare type are particularly suited for pressures above 5000 psi; the profile and V-Tite gaskets are generally used for lower pressures. Each of these is fabricated to extremely close tolerances. Other styles can be made to any desired cross section to meet your individual requirements.

For more information about Johns-Manville Goetze Gaskets, write for your copy of Catalog PK-35A. Or send us your drawing or template for an immediate quotation. Address: Johns-Manville, Box 60, New York 16, N. Y.

Johns-Manville *Goetze* GASKETS

THERE'S A JOHNS-MANVILLE PACKING AND GASKET FOR EVERY SERVICE

Test Pilot

"Just try those springs," the salesman says and his customer, canny as well as pretty, takes him at his word. She wants to be sure what she's getting.

Testing is a good way to double-check Multiwall bags too. Subject them to the toughest going you can. Make sure your manufacturer checks them also—continuously and against rigid performance standards.

In Union's testing laboratories, Multiwalls have to prove themselves constantly—for strength, durability, moisture resistance, sift-proofness, every characteristic you expect of a good package.

Union Multiwalls are *uniformly* high standard. They are manufactured in the world's largest integrated pulp-to-container plant. Only in an integrated plant can first-hand control be maintained over *every step* of the process by which your package is made.

Best proof of the value of this extra protection is in the buying habits of America's largest Multiwall users. Men who purchase more than 85 per cent of the total production of Multiwalls list* dependable quality as one of their most important considerations in choosing a Multiwall supplier.

Insistence on uniformly high manufacturing standards is one of the many good reasons why, to a greater extent each year, these major buyers turn to Union for a substantial share of their increased Multiwall requirements.

More so every day . . .

IT'S UNION FOR MULTIWALLS

*August, 1951 research study.

UNION BAG & PAPER CORPORATION • NEW YORK: WOOLWORTH BUILDING • CHICAGO: DAILY NEWS BUILDING

NEW...

the latest development by PHILADELPHIA

in cooling tower drives

SIMPLE
COMPACT
STURDY
EFFICIENT

Philadelphia Spiral-Bevel Cooling Tower Units are manufactured in five sizes, rated from 15 to 60 Horsepower at 1750 rpm motor speed.

Here are some of the features which make these single reduction Spiral-Bevel Units outstanding:

1. **High Efficiency.**
2. **Precision generated Spiral-Bevel Gears, case hardened for long service life.**
3. **Heavy duty construction.**
4. **High dome permits mounting fan directly on unit, with ample clearance below fan blades.**
5. **Spiral-bevel pinion is supported by additional outboard bearing, thus preventing any possible pinion deflection.**
6. **Oversize bearings give extra long life.**
7. **Top bearing is continually flooded with oil—no grease fittings are necessary.**
8. **First cost of Unit is economical.**
9. **Reducer meets all AGMA standards.**

Be sure your next Cooling Tower is equipped with this dependable Philadelphia Cooling Tower Drive.

Literature upon request.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

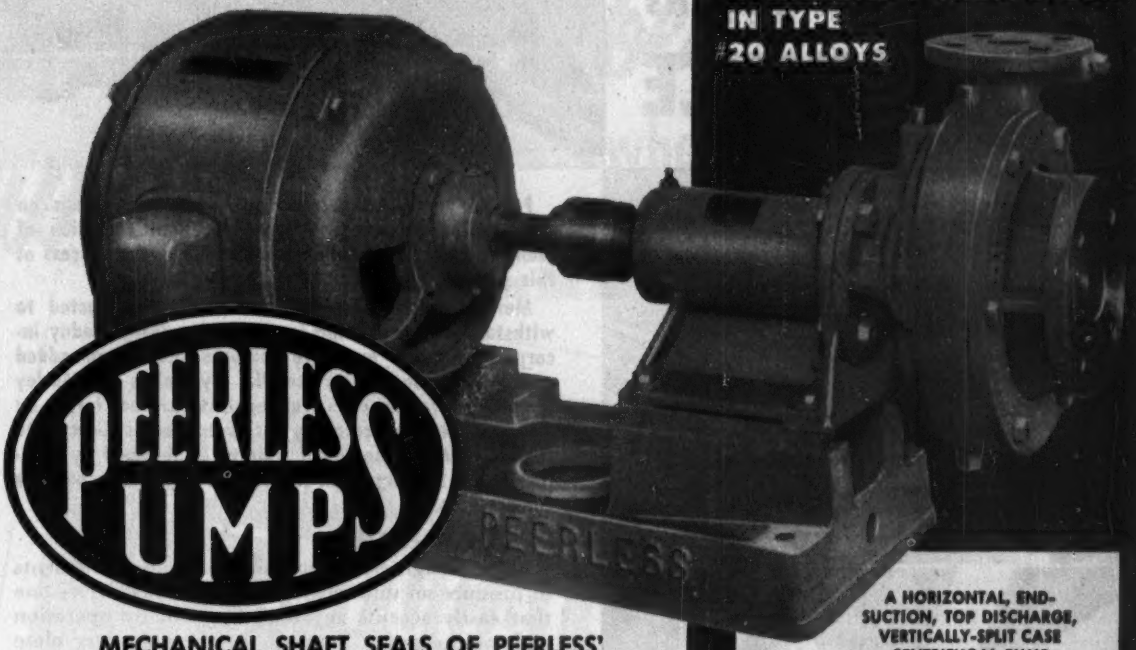
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

PEERLESS type CTB CHEMICAL TRANSFER PUMP...

For continuous or intermittent light duty in transferring process chemicals

Featuring:

MECHANICAL SEAL DEPENDABILITY
RUGGED CONSTRUCTION
QUALITY MATERIALS
QUICK MAINTENANCE
LOW INITIAL COST AND AVAILABILITY FROM STOCK IN TYPE 20 ALLOYS



PEERLESS PUMPS

A HORIZONTAL, END-SUCTION, TOP DISCHARGE, VERTICALLY-SPLIT CASE CENTRIFUGAL PUMP

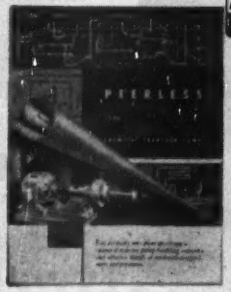
CAPACITY RANGE:	10 to 250 gpm
HEAD RANGE:	10 to 140 feet
HP RANGE:	¼ to 10 hp
CASE PRESSURE:	100 lbs.
LIQUID TEMPERATURE:	Up to 250°F
MATERIALS OF CONSTRUCTION:	Frame—cast iron Liquid End—Type No. 20 Stainless steel alloy

MECHANICAL SHAFT SEALS OF PEERLESS' OWN DESIGN AND MANUFACTURE ELIMINATE STUFFING BOX TROUBLES AND SHAFT LEAKAGE

Since the Type CTB chemical transfer pump is designed with and for a mechanical shaft seal and the stuffing box is eliminated, the Type CTB pump has less shaft overhang, reduced bearing loads, less run-out at the seal. This design also effects a sizable reduction in both pump and seal costs. The seal is Peerless' own design and construction and is available from stock.

DESIGNED AND CONSTRUCTED TO ASSURE LOW OPERATION COSTS AND LONG "IN SERVICE" CONTINUITY

Extra heavy bracket and frame construction imparts rigidity to the unit and precise alignment provides smooth running performance. Pump is equipped with heavy duty, grease lubricated ball bearings. Semi-open impeller, with repelling vanes on back of shroud minimizes recirculation losses and reduces pressure on shaft seal providing optimum seal performance. You can buy and apply the Peerless Type CTB pump with confidence. Availability of complete units and components is excellent from ample factory stocks.



WRITE FOR BULLETIN TODAY

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, California and Indianapolis, Indiana. *Offices:* New York, Atlanta, Chicago, St. Louis, Phoenix, Fresno, Los Angeles; Dallas, Plainview and Lubbock, Texas; Tulsa, Albuquerque, N. M. *Distributors in Principal Cities;* Consult your Telephone Directory.

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26
Los Angeles 31, California

Please send us a copy of Peerless Type CTB Pump Bulletin No. B-1606.

NAME_____

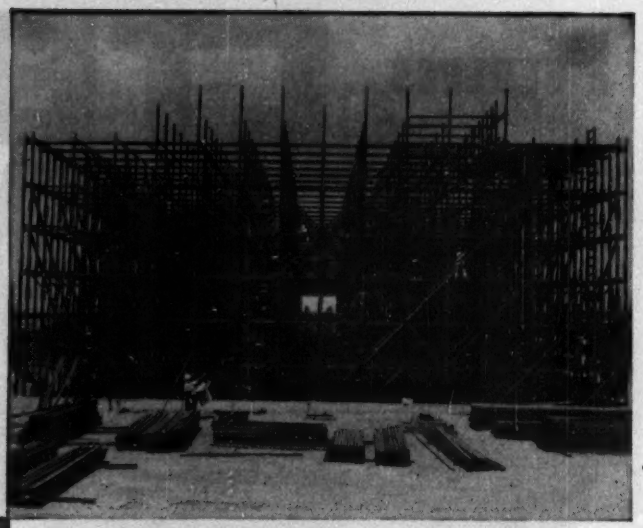
COMPANY_____

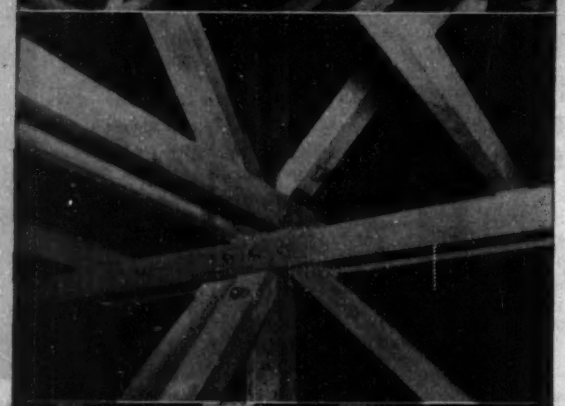
STREET_____

CITY_____ STATE_____

CHEM. ENG.

MARLEY STRUCTURAL SUPERIORITY *means* PERMANENCE





For 25 years, Marley has put primary emphasis on structural engineering. Present excellent condition of many early Marley cooling towers attests the success of this policy.

Marley towers were the first to be constructed to withstand 100 mph wind load. Marley design today incorporates many exclusive features that mean added strength . . . longer service life. Typical is the Marley method of bracing each wall against external forces by diagonal members carrying horizontal forces directly to the foundation. Maximum rigidity is obtained by independently bracing each wall with diagonals only in compression.

FAN DECK FRAMING

Marley engineering combines structural elements to produce an unusually strong rigid fan deck—one that easily accepts any load imposed by operation and maintenance. Support members on very close centers, the heavy timber foundation for mechanical equipment and tower bracing diagonals all join in supporting the heavy tongue and grooved flooring, making a perfectly integrated structure.

TYPICAL FRAMING JOINT

This distinctive Marley structural joint is made without notching any members. Diagonal joints bear in compression (wood on wood) eliminating castings and plates subject to corrosion. All horizontal members are ruggedly supported by heavy timber ring connectors at this point.

INTERIOR BASE JOINT

At this important joint vertical, horizontal and diagonal members are joined. Diagonal bracing is framed to the base of column to avoid bending stresses and all columns are held in perfect alignment by interconnection with horizontal members in two directions. Here accumulated load is transferred to the foundation by this carefully engineered system of horizontal members and base anchorage.

The Marley Company

Kansas City, Missouri

MARLEY

Curiosity can be a virtue

...when it pertains to CENTRIFUGES

Compare All Centrifuges Before You Buy . . .

We believe that the Reineveld Centrifuge rates your comparison with every brand of Centrifuge that you consider before buying for your particular requirements.

Booklet 12-RC-2 gives you full information about Reineveld Centrifugal equipment. Write for your copy today.

Then compare in detail . . . prices, production, square feet of filtering surface, construction, weight, maintenance . . . or by any yardstick that you choose. See for yourself why Reineveld is your best buy.

Heyl+Patterson, Inc.

"SINCE 1887"

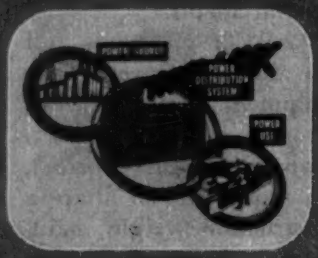
55 FORT PITT BLVD. PITTSBURGH 22, PA.

1876 75 1953
YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC
Presents

THE VITAL LINK

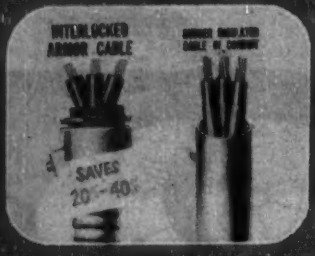
a new G-E sound color slidefilm



MODERN POWER SYSTEM
provides
GREATER RELIABILITY
GREATER FLEXIBILITY
HIGH DEGREE OF SAFETY

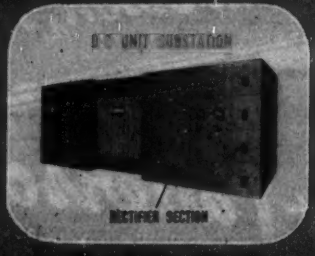
New sound color slidefilm . . . shows how modern practices keep costs down and production up

1. Use load-center distribution



6. Use Interlocked Armor Cable

and Plugin Busway



7. Use D-C unit substation systems

8. Apply Capacitors

20 minutes of modern ideas can save you thousands of plant electrical dollars

- ASSURED POWER CONTINUITY
- REDUCED INSTALLATION AND OPERATING COSTS
- FAST, EASY SYSTEM PLANNING
- PROTECTION FOR PERSONNEL AND EQUIPMENT

This new film gives a summary of the most advanced thinking in the field of plant distribution engineering in the last 10 years.

If you haven't made any changes in your plant electrical system during this period, you are probably losing thousands of power dollars each year. If you are planning expansion or modernization, then this film is even more important.

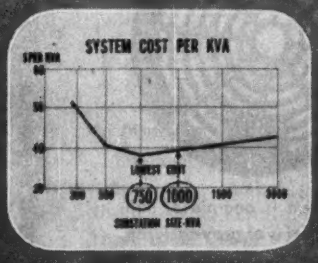
The 20-minute film, together with a 28-page Industrial Power Distribution Idea Book, will bring you up to date on the most recent engineering developments in power distribution. The film examines and evaluates a dozen ideas in this field—ideas that will help you *plan* your system from the beginning . . . *reduce* distribution costs . . . *maintain* power continuity . . . and *safeguard* both personnel and equipment.

To follow-through, you can call on your consulting engineer, your utility's industrial power sales engineer, and General Electric's sales engineer. They will help you plan and install your system—from metal-clad switchgear to load-center unit substations.

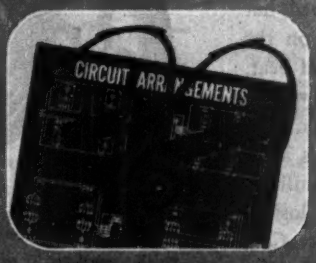
YOU CAN ARRANGE A SHOWING AT YOUR PLANT of "The Vital Link" through your nearest G-E apparatus sales representative. General Electric Co., Schenectady 5, New York. 861-2

You can put your confidence in—

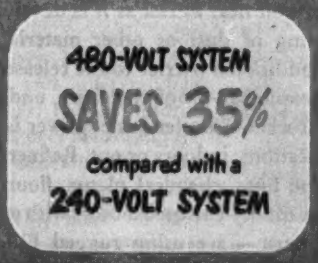
GENERAL ELECTRIC



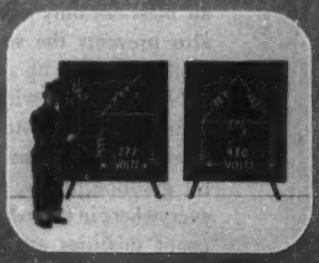
2. Choose economical substation size



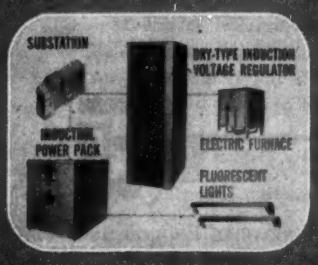
3. Select simple circuit arrangements



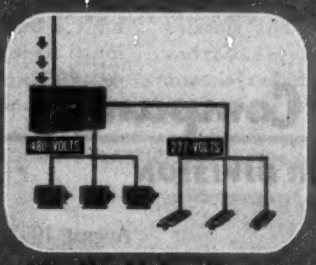
4. Select high primary and secondary voltages



5. Use system neutral grounding



9. Reduce voltage spread



10. Use high-voltage fluorescent lighting

AVAILABLE SHORT-CIRCUIT CURRENT
(SECONDARY RATING 480 VOLTS, 3-PHASE)

Available Primary 3-Phase Short-Circuit KVA	Substation KVA Rating			
	150	500	750	1500
	Low-Voltage Short-Circuit Currents 1000 Amps			
50,000	5.6	15.5	20.6	35.6
150,000	5.9	17.1	23.3	43.0
500,000	5.9	17.8	24.5	47.9
UNLIMITED	5.9	18.1	25.0	50.1

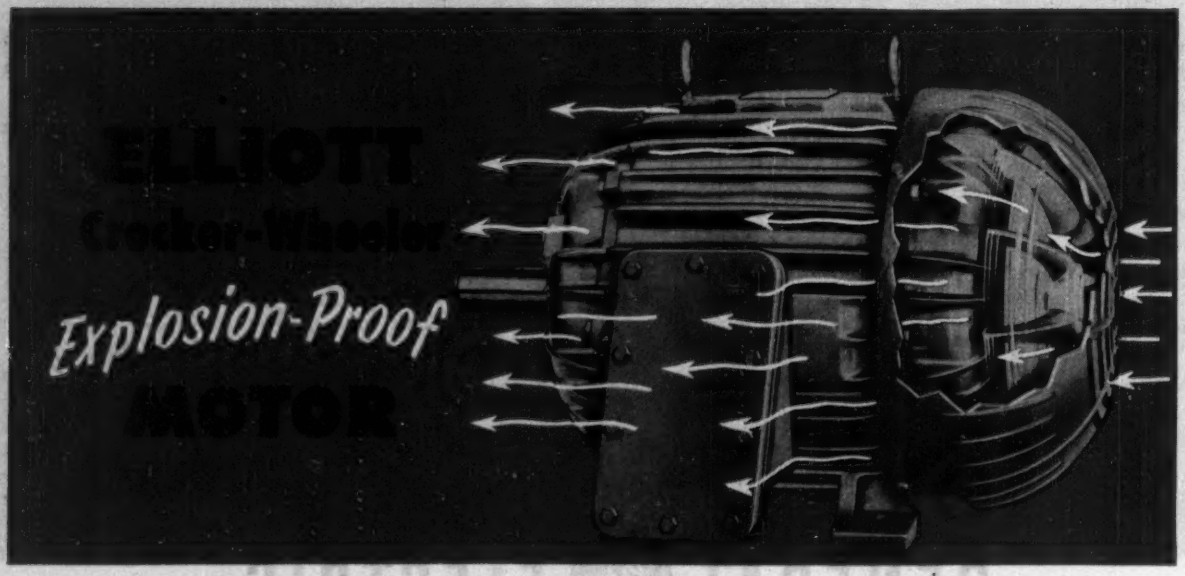
11. Be sure of your "I.C."

point of view

the CONSULTING ENGINEER
the ELECTRIC UTILITY
the ELECTRICAL MANUFACTURER

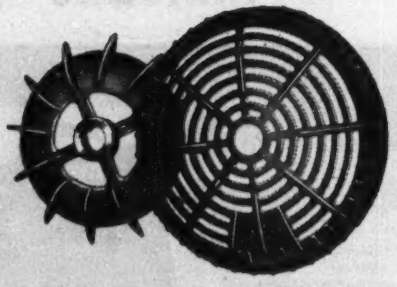
12. Take advantage of consulting services

It's self-cleaning!
It's self-cooling!
It's explosion-proof!



Here's a totally-enclosed motor that acts as its own heat exchanger, driving a directed blast of air around the *outside* of the motor along the full length of the heat-radiating fins. This air blast not only sweeps off heat as fast as it is developed, but also prevents the settling of dust or other material on the motor, building up an additional barrier to the release of heat.

Now available with explosion-proof enclosure, underwriters approved, the Elliott Crocker-Wheeler Sealedpower is an ideal motor for hazardous locations, indoors or out. Refineries, natural gasoline plants, pipe lines, chemical plants, flour mills — everywhere in fact where totally-enclosed motors with explosion-proof qualities are a must — are using rugged Elliott C-W Sealedpower motors with full satisfaction. In NEMA frames, ratings to 100 hp. For full data, contact your nearest Elliott district office or write Elliott Company, Jeannette, Pa.



THE FAN AND COWL. *Fan is one-piece, non-sparking bronze. The cowl is of gray cast iron, so designed as to direct the flow of cooling air along the outside surface of the frame.*

ELLIOTT Company

CROCKER-WHEELER DIVISION

W3-9

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Co. does not make this industrial filter. We supply the Geon vinyl resin only.

CORROSION-RESISTANT PLASTIC REPLACES METAL—COSTS 66% LESS!

HERE'S another new use for rigid Geon vinyl plastic—one that improved the product and saved money to boot!

Formerly, expensive metal alloys were used to make essential parts of the leaf-type, acid filter pictured. But these metal parts would be eaten by corrosion—some in a matter of hours. Costly replacements and lost time ran up expenses.

So the manufacturer tried a rigid Geon vinyl plastic. He found it not only had the required corrosion resistance, but cost 3 to 4 times *less* than special metal alloys. Now the filter leaf frames, nuts and bolts holding the leaves together, rollers holding the leaves in place, heel plate and various pipe fittings are all made from rigid Geon.

Versatile Geon vinyl materials have helped solve many problems. Products made from them can be either rigid or flexible, transparent or colored. And Geon resists acids, alkalies, most solvents and other chemicals, heat and cold. Let us help you select a Geon material suited to your needs—to help you improve or develop more saleable products. For technical information, please write Dept. GE-8, B.F.Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

Homogeneous Lead Bonded Equipment

By Our "New Mechanical"* Process

*Our newly developed "mechanical" process for applying Homogeneous Lead Bondings affords you a considerable saving in both delivery time and cost over the slower "hand-burning" method.

We suggest that you pay a visit to our plant and view this newly developed "Mechanical" cost-saving lead bonding process. Our Engineers are available for consultation without obligation. Your inquires are solicited.

TANKS · LEAD COILS
LEAD and LEAD LINED VALVES
SHEET LEAD LININGS
CASTINGS and FITTINGS

Custom Built for the Processing Industries

KELLEY

STAINLESS STEEL
LEAD
WOOD
STEEL
Fabrication

O. G. KELLEY & CO.

ENGINEERS DESIGNERS FABRICATORS

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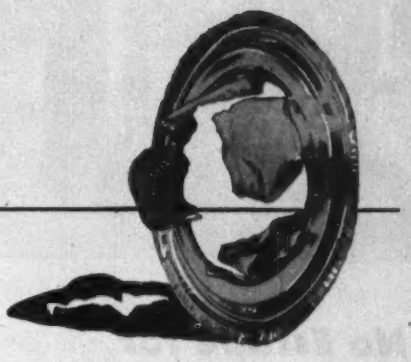
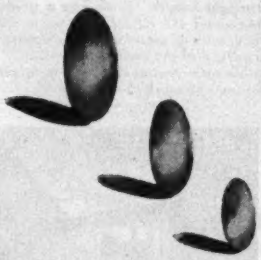
CLEVELAND, OHIO · NEW YORK, N.Y. · PITTSBURGH, PA.
HOUSTON, TEXAS · JOHNSON CITY, TENN. · ELIZABETH, N.J.

Instant...Automatic Release

of Excess Pressure with...



Baker Rupture Discs

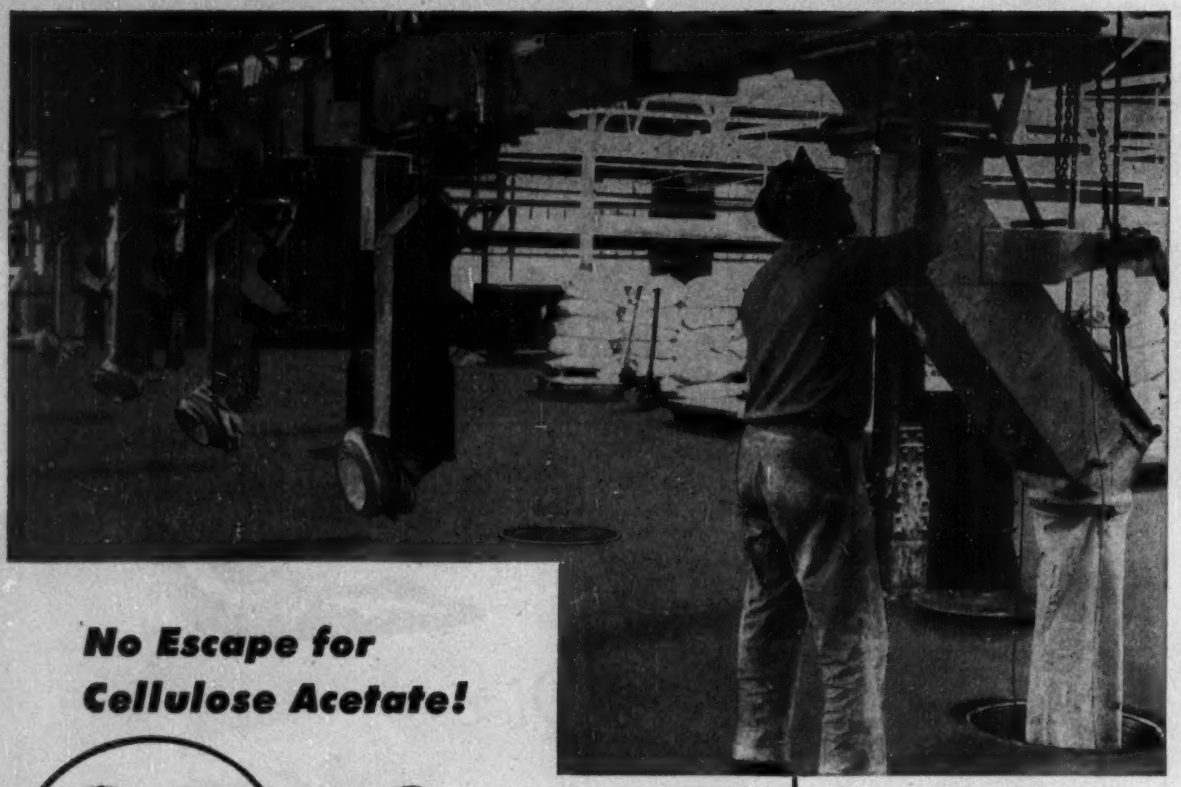


In emergencies, Baker Rupture Discs act instantly and automatically to protect your equipment if the standard relief valve fails or operates too slowly. They have no small passages or moving parts to clog or corrode . . . Made of precious metals or, for some applications, of base metals coated with platinum, gold or silver on one or both sides, they are immune to corrosion. Each is specifically designed to fit the conditions under which it must operate—to give constant protection indefinitely without attention or maintenance of any kind.

Baker Rupture Discs are made in a wide range of sizes, guaranteed to blow at any desired pressure within limits. Write Dept. R for detailed descriptions. Fast deliveries!

BAKER & CO., INC.

113 ASTOR STREET, NEWARK 5, NEW JERSEY
NEW YORK • SAN FRANCISCO • CHICAGO



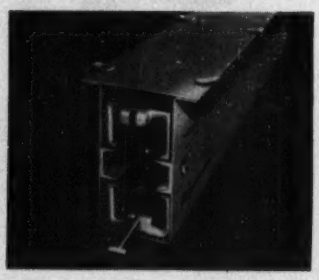
No Escape for Cellulose Acetate!

S-A CONVEYING System provides SELECTIVE FEEDING

to mixers, with no dust or impurities

CELANESE CORP. OF AMERICA
Amcelle Plant
Cumberland, Maryland

From huge steel storage tanks, cellulose acetate moves through totally enclosed REDLER conveyors and elevators to a weight hopper. From here a series of horizontal 13" REDLERS up to 140 feet long, with as many as nine discharge points, feed the various mixers. Slide gates control discharge to mixers through pivoting chutes.



At this plant an S-A System of REDLER conveyors and elevators keeps cellulose acetate moving at rates up to 20 tons per hour. Dust-tight, uncontaminated delivery of the cellulose acetate, as needed to any of numerous mixers, was specified.

Difficult or unusual handling problems are nothing new to S-A engineers. They've been solving them for more than half a century, with the help of the complete S-A line of bulk handling units—*all types for all purposes!* Add the two—S-A experience *plus* S-A equipment—and you'll get a money saving answer to practically *any* bulk materials handling problem . . . Write and we'll arrange a free survey, without obligation.

REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Vibrating Conveyors
Belt Conveyors
Screw Conveyors
Bucket Elevators
Pan Conveyors and Feeders
Circular Bin Dischargers
Centrifugal Loaders and Filers
TELLEVEL Bin Level Controls
Ship Loaders and Unloaders
Storage and Reclaiming Systems
Box Car Loaders and Unloaders
Bin Gates, All Types
SEALMASTER Ball Bearing Units

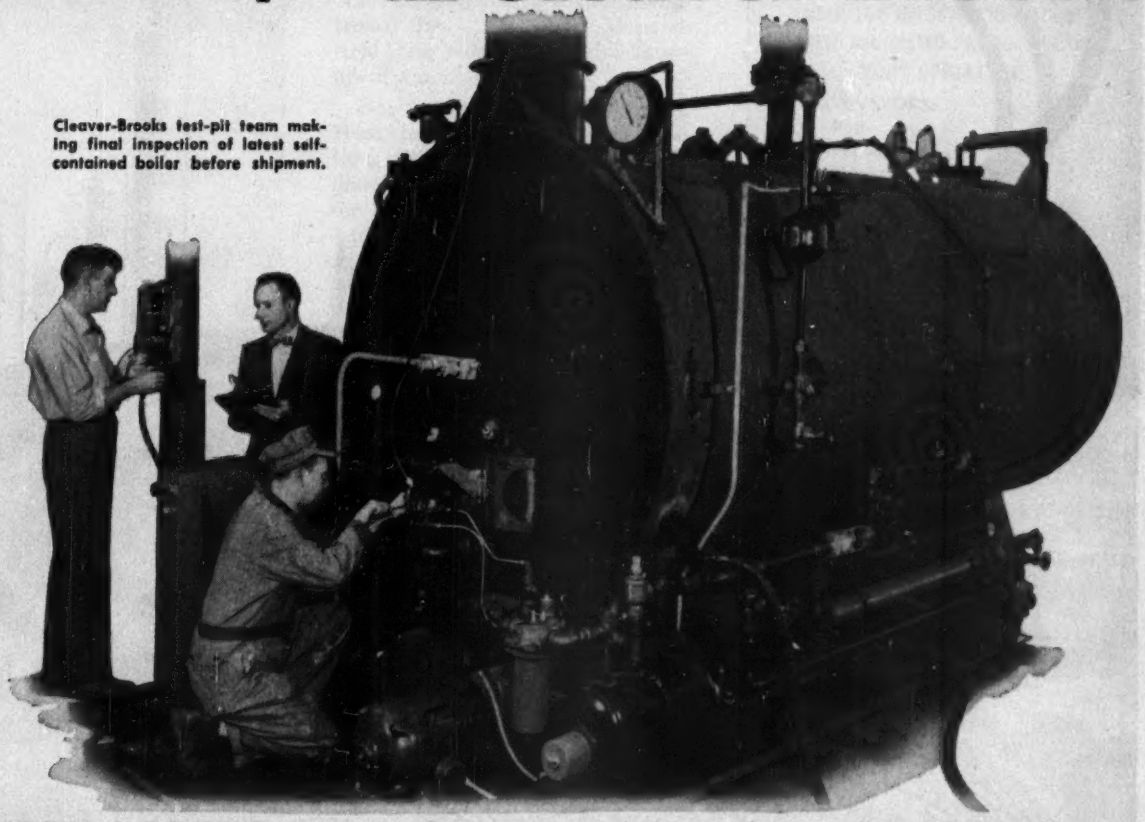
Write for Bulletins on any of the above.

STEPHEN S-A ADAMSON MFG. CO.

3 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

their counterpart "Test-Pilots" have at Cleaver-Brooks



Cleaver-Brooks test-pit team making final inspection of latest self-contained boiler before shipment.

HIGH SCORES . . . on factory and on-job tests guarantee greatest return from boiler investment

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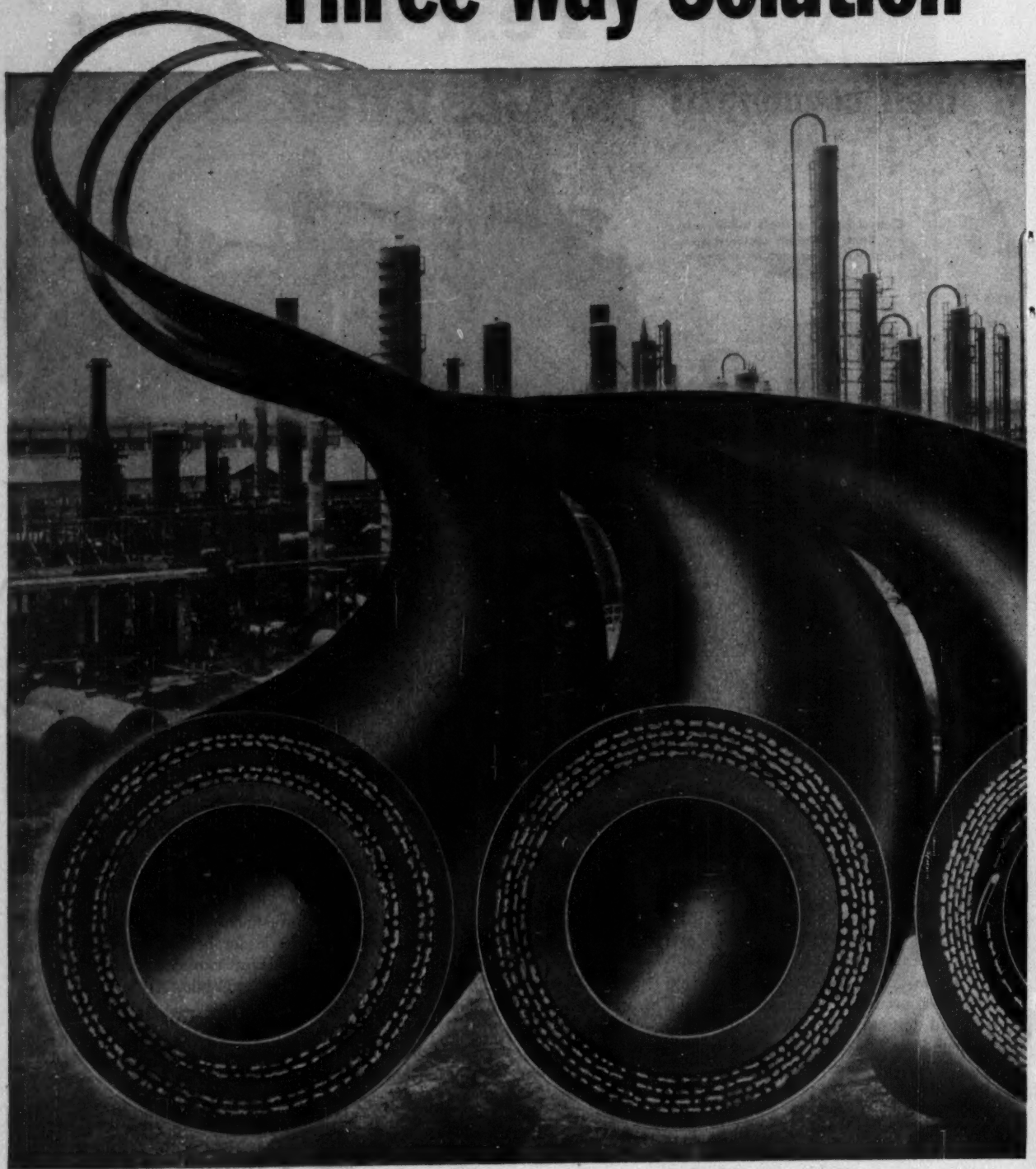

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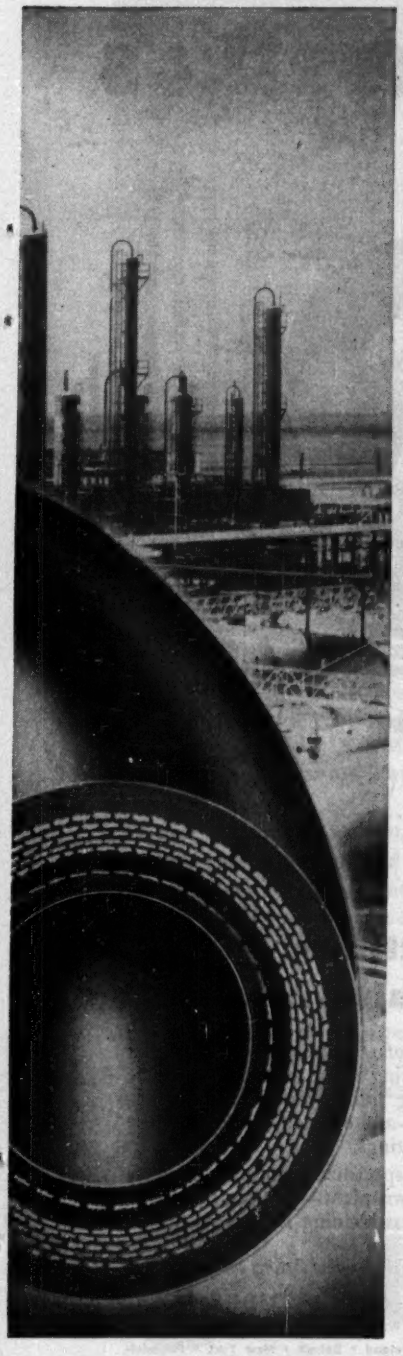
to Acid Handling Problems



Whether your problem is conductance of acids and chemicals under pressure, syphoning or suction or controlled flow . . . Hewitt Monarch Acid Hose is designed to give longer life at a minimum cost.

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ACID PINCH VALVE HOSE—two separate reinforcing walls of high-tensile cotton duck insulated from each other by a thick layer of pure gum rubber, provides maximum flexibility, assures greatest service life by eliminating crushing of duck by pinch bars when controlling flow.

ACID SUCTION HOSE—a helix of round spring wire between multiple plies of high-tensile duck provides resistance to suction forces . . . flexible, easy to handle.

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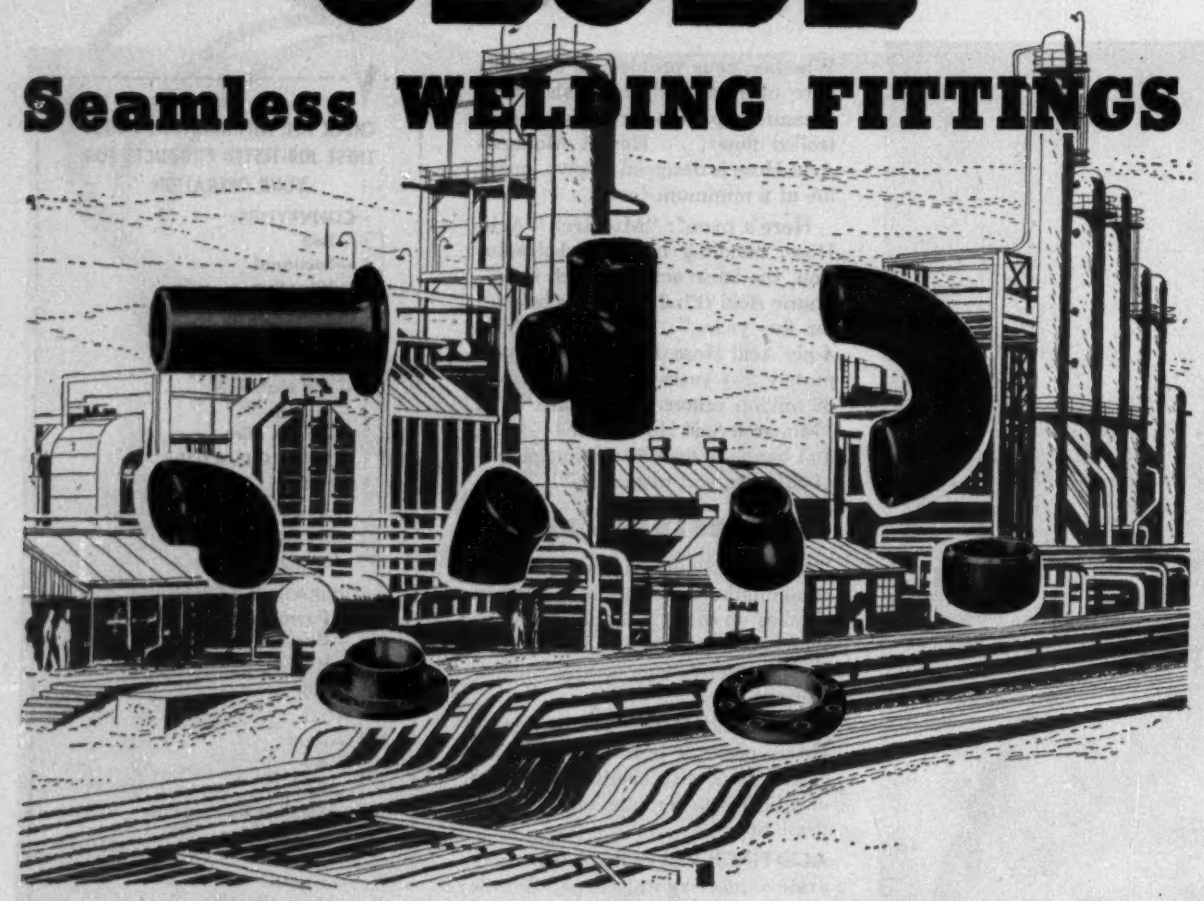
Seamless WELDING FITTINGS



The only seamless welding fittings precision-processed . . . from billet . . . to tube . . . to fitting

From charging the specially designed revolving furnace with a steel billet (above) through the many succeeding steps of production, every Globe process is specialized to produce fittings of unvarying quality.

Globe precision-process manufacture begins with the billet —continues through the making of the seamless steel tube (Globe alone among welding fittings manufacturers produces seamless steel tubes)—and extends through to the production of the finished fittings.

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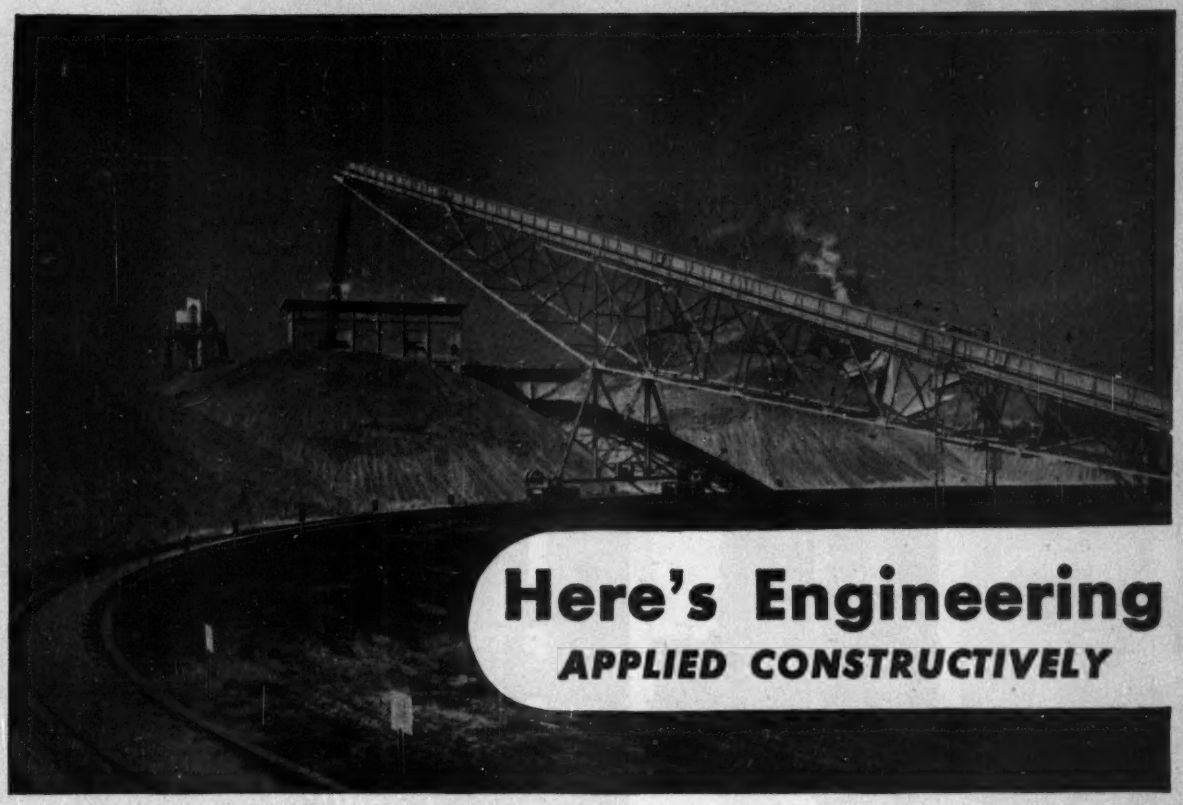

Here's Engineering
APPLIED CONSTRUCTIVELY

A belt stacker designed by Jeffrey Engineers becomes an important part of a new-type storage system installed in Florida. Result: Continuous, dependable operation and accurate blending.

Saving: A unique system, the facilities of which prevent delay of railroad equipment and provide better service to customers by permitting quicker deliveries of more-accurately-blended phosphate rock.

How it works: From track hopper rock is fed at 600 to 800 T.P.H. on to a Jeffrey 36" belt conveyor, running up an 80-foot high Stacker which pivots (see photo) over a wide semicircle. Rock is dropped on storage piles consisting of various grades at different points. Grades are blended by proportioning through gates and reclaimed by other Jeffrey belts operating in tunnels under piles. Rock can be removed at controlled rate from any point in the pile, or at several points at once.

This is just one of the many Jeffrey-equipped jobs on which our engineers projected an ingenious application of the Belt Stacker. For applied engineering on those tough assignments — call on Jeffrey.

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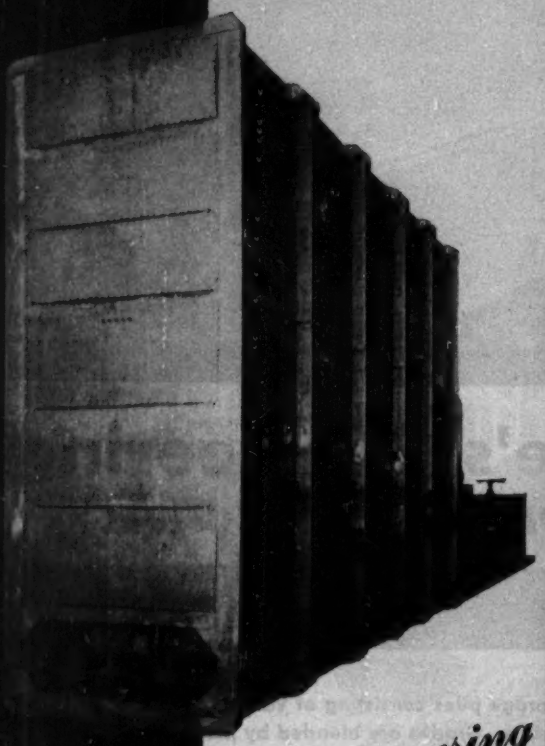

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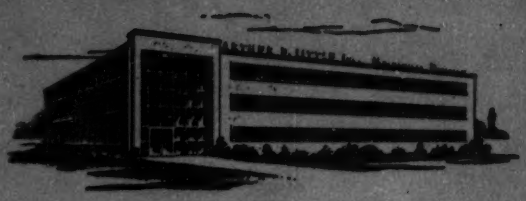
LIQUID OXYGEN PLANT

An unusual 10 ton/day, liquid oxygen generator was developed and built for the United States Air Force. This prototype plant was designed for simple disassembly for air transportability, where small size and light weight are major objectives. It utilizes the low pressure expansion turbine and reversing exchanger principles.



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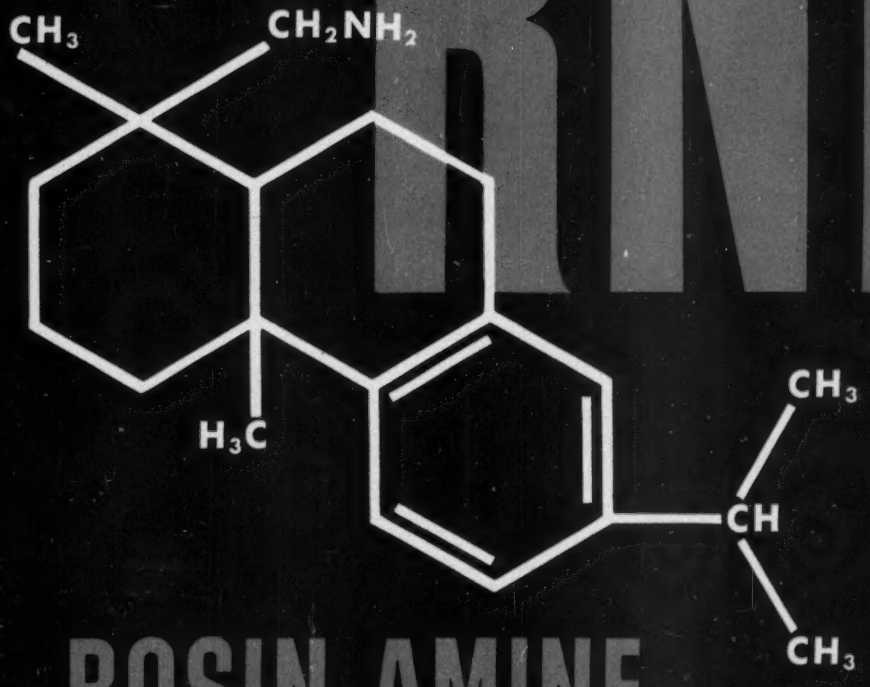
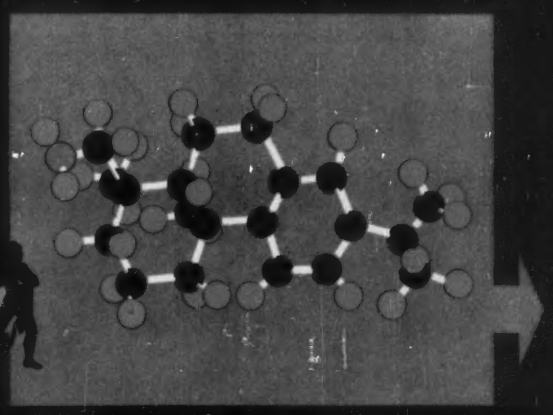
STARTING POINT

RNH_2

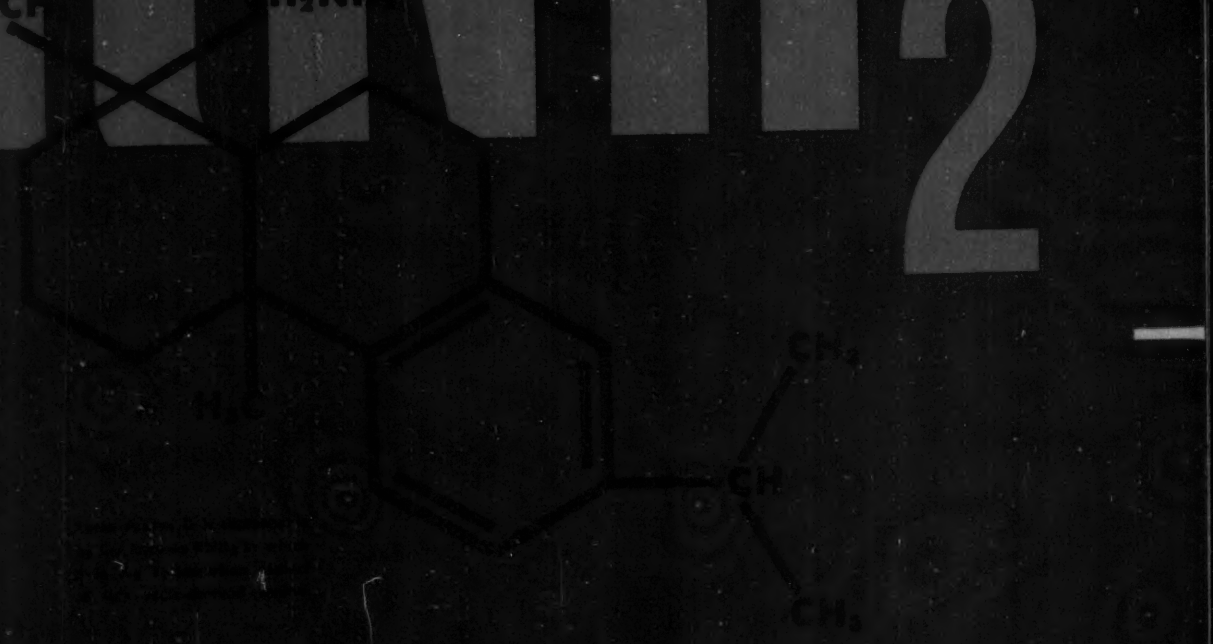


ROSIN AMINE



HERCULES POWDER COMPANY
INCORPORATED

RNH_2



SOME OF THE THINGS THAT ROSIN AMINE D CERTAIN DERIVATIVES CAN DO

DO THESE KNOWN REACTIONS OF ROSIN AMINE D SUGGEST OTHERS TO YOU?

Reaction With Acids To Form Salts

Hercules Rosin Amine D reacts with acids and other substances containing a group which functions as an acid (such as a phenolic hydroxy group) to form salts, example:

$$RNH_2 + CH_3COOH \longrightarrow RNH_2 \cdot CH_3COOH$$

Typical acids which may be used include hydrochloric, boric, acetic, stearic, adipic, benzoic, naphthenic, various sulfonic acids, and acidic-reacting phenols such as pentachlorophenol.

Reaction With Acids To Form Amides

Some Rosin Amine D salts can be heated to form the substituted amides, example: the heating of RADA (Rosin Amine D Acetate) to a relatively high temperature gives a substituted acetamide.

$$RNH_2 \cdot CH_3COOH \xrightarrow{\text{heat}} CH_3CONHR + H_2O$$

Reaction With Ethylene and Propylene Oxides To Form Condensates

Rosin Amine D reacts with ethylene oxide to form condensates, example: the polyethylene glycol ethers of the diethanol derivative.

$$RNH_2 + CH_2CH_2 \longrightarrow RN\text{-}(CH_2CH_2O)_nCH_2CH_2OH)_2$$

Other oxides such as propylene oxide and glycidol (2,3-epoxy-1-propanol), or mixtures of oxides may be used in place of ethylene oxide to form adducts.

Reaction With Carbon Disulfide To Form A Dithiocarbamate Or Thiourea

Rosin Amine D reacts with carbon disulfide to form the Rosin Amine D salt of an N-substituted dithiocarbamic acid:

$$2RNH_2 + CS_2 \longrightarrow RNHCSSHNH_2R$$

Heating the above salt yields an N,N'-substituted thiourea:

$$RNHCSSHNH_2R \xrightarrow{\text{heat}} RNHCSHNR + H_2S$$

Reaction With Metal Salts To Form Metal Complexes

Complex metal salts are formed by reacting Hercules Rosin Amine D with metal salts. Generally, two moles of Rosin Amine D and one mole of the metal salt are involved in this type of reaction, example:

$$2RNH_2 + (CH_3COO)_2Cu \longrightarrow 2RNH_2 \cdot (CH_3COO)_2Cu$$

Complex salts of copper, zinc, silver, nickel, manganese, cobalt, mercury, calcium, aluminum, iron, and chromium have been prepared. Usually the acetate of the metal is used, but other salts including the sulfate, chloride, and nitrate also react. The resulting products are resinous in character and are soluble in organic solvents.

Reaction With Phosgene To Form Rosin Isocyanate

Rosin Amine D hydrochloride reacts with phosgene to yield rosin isocyanate:

$$RNH_2 \cdot HCl + COCl_2 \longrightarrow RNCO + 3HCl$$

This isocyanate will react with a variety of compounds containing active hydrogens.

Reaction With Acrylonitrile To Form A Diamine Or An Amino Acid

Rosin Amine D reacts readily with acrylonitrile to form an adduct:

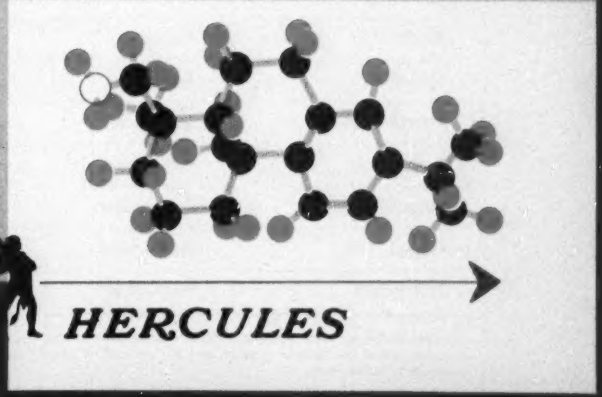
$$RNH_2 + CH_2{=}CHCN \longrightarrow RNHCH_2CH_2CN$$

which is readily hydrogenated to a diamine:

$$RNHCH_2CH_2CN + 2H_2 \longrightarrow RNHCH_2CH_2CH_2NH_2$$

or is readily hydrolized to form an amino acid:

$$RNHCH_2CH_2CN + 2H_2O \longrightarrow RNHCH_2CH_2COOH + NH_3$$



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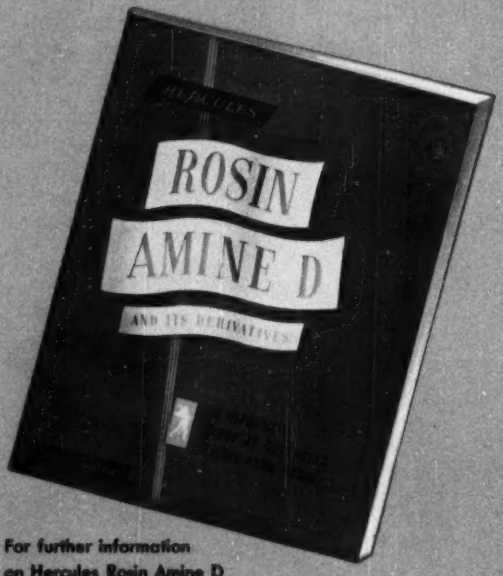
- Viscose Rayon Manufacturing

HERCULES ROSIN AMINE D PRODUCTS COMMERCIALLY AVAILABLE

PRODUCT	CHEMICAL NATURE
Rosin Amine D	Primary amine; oil-soluble
RADA (Rosin Amine D Acetate)	Water-soluble acetate salt
Rosin Amine D Naphthenate	Oil-soluble salt
Rosin Amine D Stearate	Oil-soluble salt
Rosin Nitrile D	Primary nitrile; oil-soluble
Polyrad®	Ethylene oxide derivatives
Polyrad 0100	Oil-soluble
Polyrad 0200	Oil-soluble
Polyrad 0500	Acid-soluble
Polyrad 0515	Acid-soluble
Polyrad 0515A	Acid-soluble
Polyrad 1100	Water-soluble
Polyrad 1110	Water-soluble
Polyrad 1110A	Water-soluble
Polyrad 2000	Water-soluble

The facts stated and recommendations made for Rosin Amine D and its derivatives are based on Hercules research and the research of others, and are believed to be accurate.

460-469 HASD-2



For further information on Hercules Rosin Amine D and its derivatives, send for this book.

One Sure Way to Get MORE DEFENSE FOR LESS MONEY

How can we get more national defense for less money? The best answer yet given to this question appears in a little-noticed section of the new defense budget. That answer, with which this editorial is concerned, is to provide more equipment with which to step up munitions production in an emergency. Thus we can eliminate much of the need to stockpile finished munitions in advance.

The new defense budget provides an appropriation of $500 million, to be invested by the Secretary of Defense in specialized facilities required to produce munitions on a wartime scale, but not adapted to profitable operation by private industry in normal times. Facilities of this type are known as "stand-by capacity."

There is no strictly political controversy over the "stand-by capacity" program. It was originally suggested by Clay Bedford, Special Assistant to the Secretary of Defense during the Truman administration. It has since been reviewed and endorsed by the Eisenhower administration. Moreover, it involves little or no technical controversy. Civilian and military experts are well agreed that the only alternative to enormous expenditures for stockpiling military equipment is to provide enough facilities for producing it quickly in an emergency.

Here is the Key Idea

In his speech of May 19, introducing his defense budget to Congress and the nation, President Eisenhower stressed the value of such reserve capacity in these terms, ***"The more swiftly and smoothly we can mobilize, the less our dependence upon costly standing armies and navies."***

In accord with this idea, the $500 million requested for the present reserve capacity program would be invested in tools that require a long time to produce, and so present grave complications in an emergency unless they are ready in advance. Some such tools would be installed in new plants that are needed to eliminate potential bottlenecks in the defense production program. Others would be ordered to replace that part of the government's present machine-tool inventory which is made obsolete by changes in the design of defense products. By completely "tooling up" with the most modern equipment, the admin-

istration hopes to realize a production potential many times greater than could be achieved by spending the same amount of money on military end-products.

Examples of Savings

In the specialized field of defense production, adequate modern capacity is the key to both economy and speedy delivery in a pinch. Here are some striking examples from the recent report of the Advisory Committee on Production Equipment (Vance Committee) to the Director of Defense Mobilization:*

—In the case of certain ammunition components, the cost of new capacity can be recovered in only six weeks of full production.

—If $500 million worth of special tools needed to make aircraft are purchased in advance, aircraft production during the first two years of war will be increased about $18 billion. In other words, it costs 1/36 as much to acquire the tools in advance as to acquire the aircraft.

—In the case of a certain ordnance item, an expenditure equal to the cost of only 150 units of the item will provide the capacity to produce thousands and save three years' time in meeting mobilization requirements.

Moreover, reserve plants and equipment can be kept up-to-date at only a small fraction of the cost required to maintain an up-to-date reserve of military end-products. The cost of replacing 5,000 obsolete tanks is at least $1 billion. The cost of new tools for a tank plant would be less than 10% of that amount.

*This Committee, headed by Mr. Harold Vance, President of the Studebaker Corporation, included Clay Bedford, then President of Chase Aircraft, Manly Fleischman, former Defense Production Administrator, and several retired military leaders with wide experience in procurement.

Savings Will Multiply

On the basis of facts like these, the Vance Committee recommended that the Defense Department spend $500 million to $800 million per year on specialized defense production facilities in order to provide substantial reserve capacity as soon as possible. It also recommended that expenditures for military end-products which get obsolete rapidly be held to a minimum. The Eisenhower administration has adopted this approach to the problem of munitions production in asking that $500 million be invested in reserve capacity.

The importance of this approach is much greater than is indicated by the amount of money to be spent on new tools, although this amount will go far toward assuring a healthy machine tool industry, adequate to meet emergency demands. ***What is really important is the great saving that can eventually be made in the cost of our defense program by a modern tooling program.*** If we are to maintain this program for a long period, and if we are to pay as we go, we must have a low-cost program. No other plan to reduce and control the cost of a garrison economy can compare with the new approach suggested in the Vance Report and now embodied in the new defense budget.

Congressmen will do well to scrutinize all military appropriations carefully. They have a chronic tendency to be too big. But there should be no penny-pinching on investments in capital equipment that will pay out in as short a time as six weeks in a war emergency. It would be tragic if this opportunity for real economy were lost in the controversy over other aspects of the defense program. ***The tooling program is a key part of the Eisenhower effort to cut defense costs. It should be promptly approved.***

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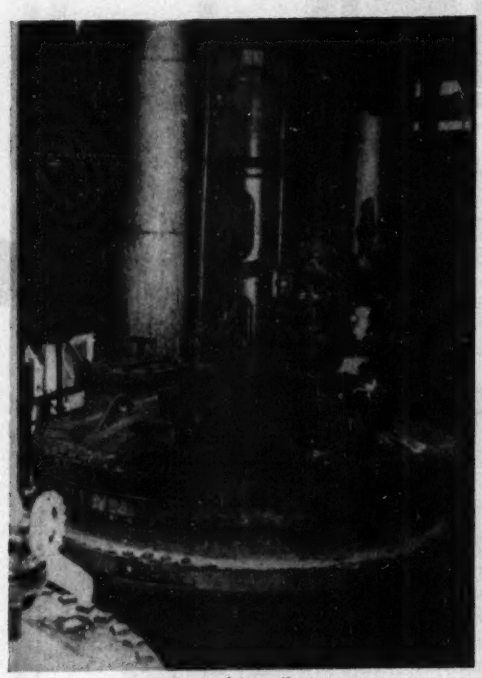

A Typical Installation

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FOR CORROSIVE SERVICE

For Example, take Sulfonators:

Bethlehem has wide engineering experience and complete facilities for design and production of kettles, in special and silicon cast iron, Ductile iron, fabricated steel, stainless, alloys, and alloy clad to meet the variety of corrosive conditions found in sulfonation processing.

The following drawing illustrates some of the salient features of process and mechanical design considered when designing these kettles.

For details regarding Bethlehem Kettles write us today.

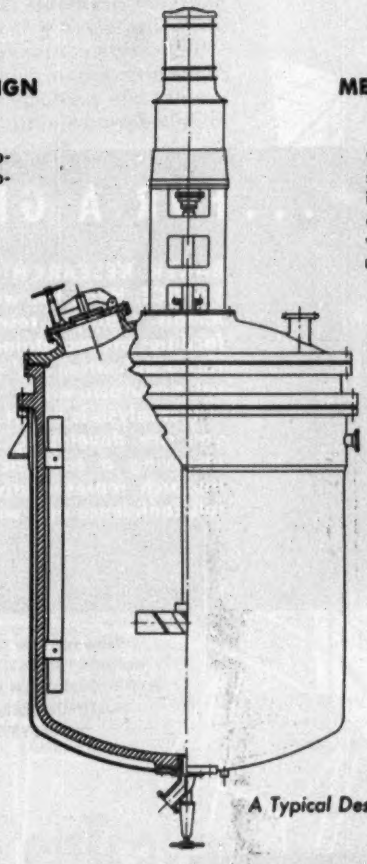
PROCESS DESIGN

Materials selected for optimum resistance to corrosion and abrasion.

Agitation systems contrived to best meet process requirements and yet to allow for flexibility due to changed process conditions, materials, liquid depth.

Heat transfer scheme—by jacket with inlet locations, baffles, or steel coils welded to or cast in wall—develope high rates of thermal transfer.

Shape of vessel designed to facilitate heat transfer, give complete agitation, allow for good drainage and assure maximum resistance to corrosion.



A Typical Design

MECHANICAL DESIGN

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Elements worked out to exploit available shapes and design details, to provide exacting fabrication at reasonable cost.

Outlets of number, size and location to adequately meet present and anticipated service.

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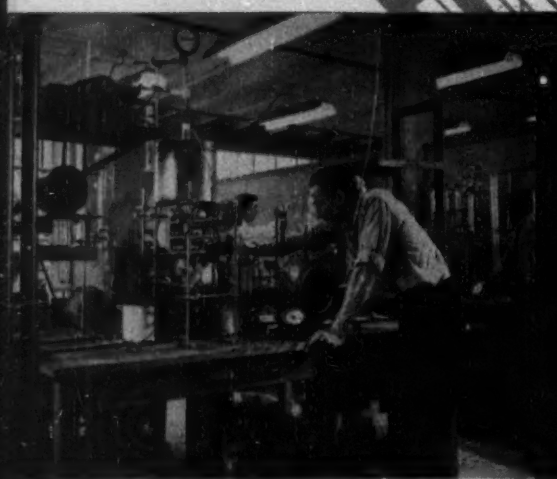

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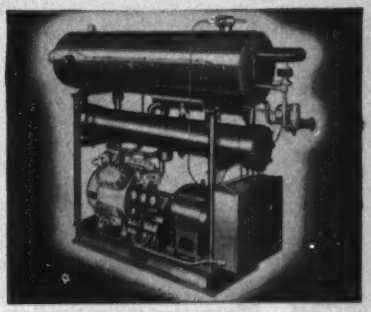
5. Fewer moving parts mean fewer breakdowns, less maintenance. No shaft seals or gear boxes at all. Only *one* major moving part.

6. Built-in automatic capacity control permits operation down to 10% of rated capacity . . . saves power.



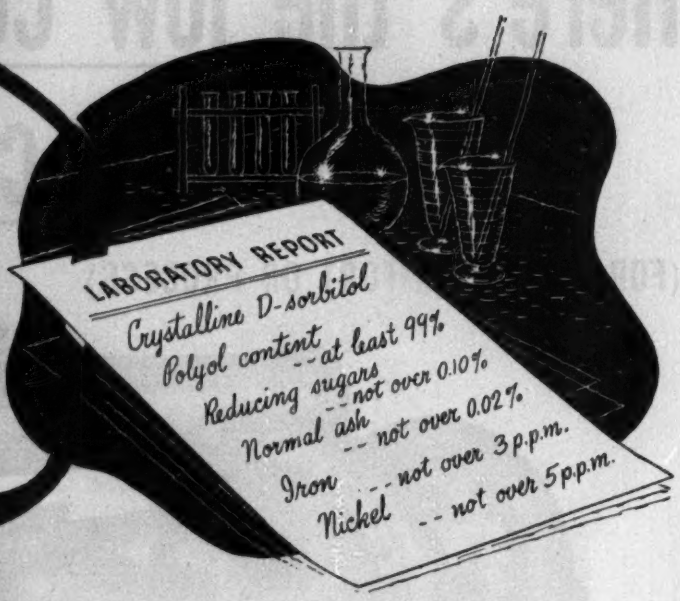
Here's the answer for 10 to 50-ton jobs! A completely packaged water chiller . . . ready to install. The new TRANE Cold Generator comes completely assembled wired, piped, refrigerant-charged.

TRANE CenTraVac cuts chilled water costs 6 ways

The Trane Company, La Crosse, Wis. • East. Mfg. Div, Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

BUY POLYOLS ON FACTS


LABORATORY REPORT
Crystalline D-sorbitol
Polyol content -- at least 99%
Reducing sugars -- not over 0.10%
Normal ash -- not over 0.02%
Iron -- not over 3 p.p.m.
Nickel -- not over 5 p.p.m.

offers premium purity

You can be sure of utmost purity when you specify sorbitol. Purity starts with the raw material—high grade natural sugars—of the same quality used in food manufacture. Purity is guarded by rigid quality control of every step of processing in the Atlas plant. The result: a polyol whose specifications for reducing sugar, ash and trace metals are so strict that sorbitol is even pure enough to use in ticklish vitamin B-12 syrups.

new value to your product

Sorbitol's cool, sweet taste and bodying action create distinctive effects in pharmaceuticals. Its superior humectant properties help dozens of products to become more impervious to drying and shelf aging. And its uniform purity makes sorbitol an ideal starting material for high quality resins, varnishes and surfactants.

Plan now to utilize these qualities of sorbitol in your production. Atlas specialists will be glad to offer technical assistance.

Write for this new booklet, "The Sorbitol Story", which highlights the reasons why sorbitol is a better polyol at a lower price.

INDUSTRIAL CHEMICALS DEPARTMENT

ATLAS POWDER COMPANY

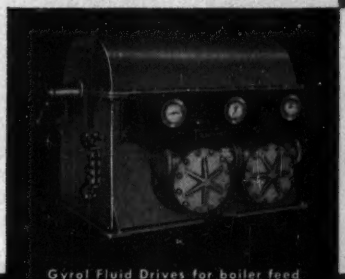
WILMINGTON 99, DELAWARE

offices in principal cities

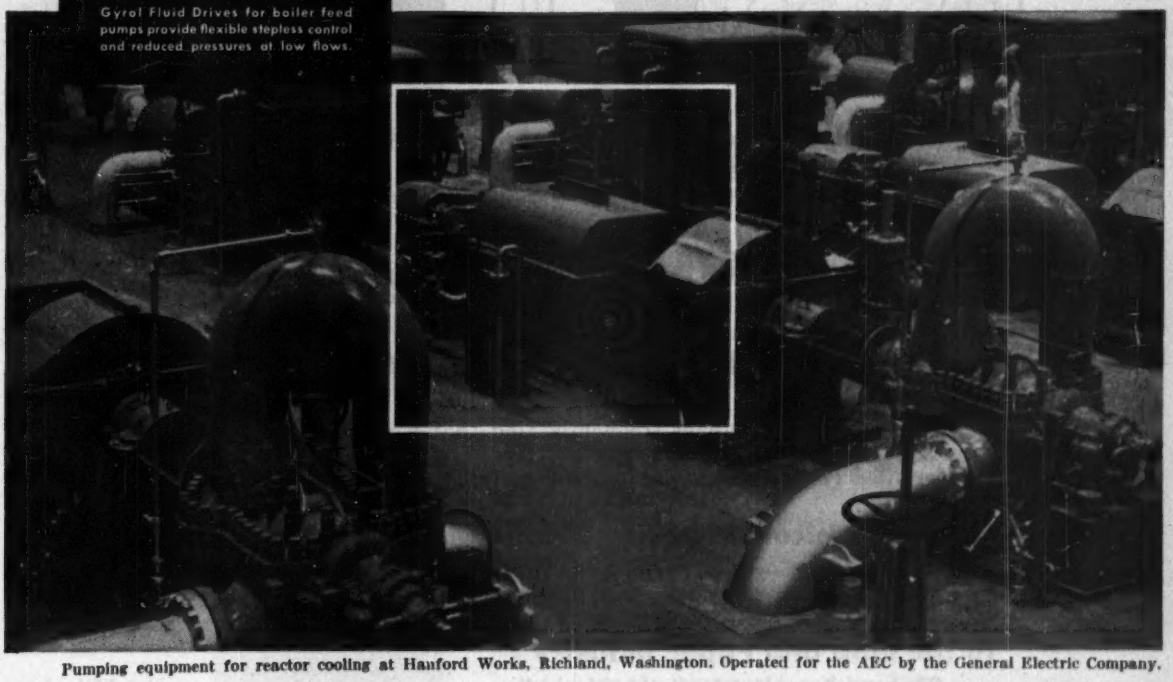
ATLAS POWDER COMPANY, CANADA, LTD.
BRANTFORD, CANADA

GYROL *Fluid Drive*

controls river of water to cool hot Plutonium



Gyrol Fluid Drives for boiler feed pumps provide flexible stepless control and reduced pressures at low flows.



Pumping equipment for reactor cooling at Hanford Works, Richland, Washington. Operated for the AEC by the General Electric Company.

SO HIGH ARE THE TEMPERATURES around the nuclear reactors, or atomic "piles," that large, dependable, accurately and automatically controlled flows of pure high-pressure water are required for reactor cooling.

American Blower Gýrol Fluid Drive acts as the traffic cop for this mighty river of water. Remotely controlled, the fluid drive permits operation of the flywheel and feedwater pump at *variable* speeds (depending on water volume); also saves power by allowing the unit to start with the load disconnected.

This unique installation, first of its type in this country, is another example of American Blower leadership in power transmission.

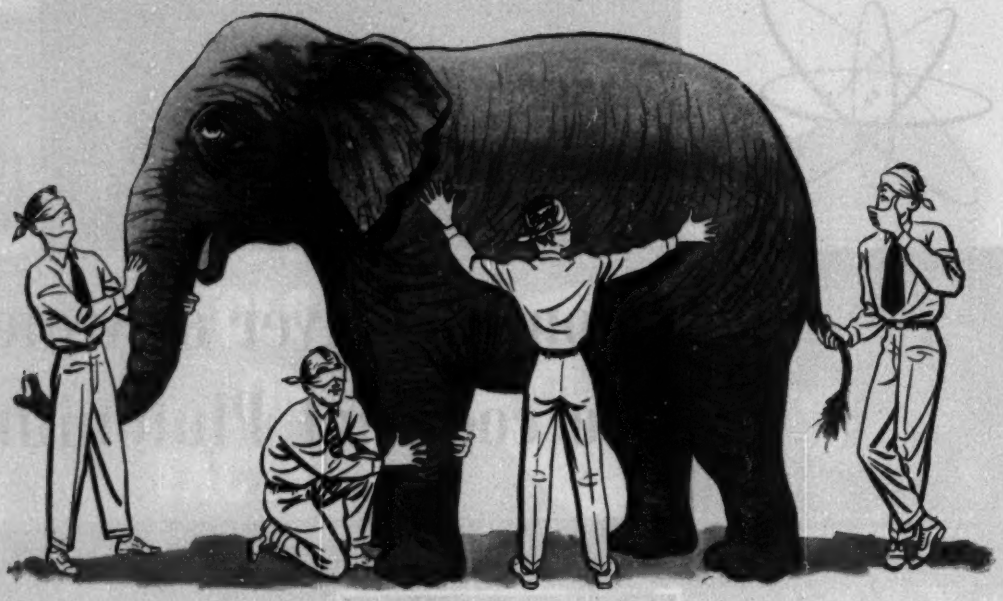
If you require the benefits of lower starting current, smoother acceleration, overload protection and shock absorption on the equipment you buy or use, specify American Blower Gýrol Fluid Drives.

For complete data, contact the nearest American Blower Branch Office conveniently located in principal cities.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS



Remember the Aesop fable where four blind men each felt a part of an elephant and decided differently as to what it was? The moral of this fable is—you need to have ALL the facts before you know the WHOLE story.

What Does GB Mean to Your Industry

We at Goslin-Birmingham frequently find that a customer in a given industry is familiar with only one phase of our activities and does not realize how diversified our engineering and plant facilities really are.

To the Chemical Industry

GB is the leading supplier of evaporators, filters, flakers, heavy castings and fabricator of special equipment.

To the Pulp and Paper Industry

GB furnishes almost all the black liquor evaporators in the recovery process.

To the Petroleum Industry

GB furnishes filters for both MEK and Propane dewaxing plants.

To the Sugar Industry

GB has for generations furnished mills, evaporators and pans to the industry.

When you are in search of engineering consultation or a competitive bid on any type of equipment . . . remember

GOSLIN-BIRMINGHAM MANUFACTURING CO., Inc.

BIRMINGHAM, ALABAMA

They Shed Splashes

Like Water Off a Duck's Back

FOR INDOOR AND OUTDOOR USE—IN A WIDE RANGE OF TYPES AND SIZES

1 to 125 HP Squirrel Cage Induction 3 Phase *Splash Proof*

150 to 400 HP Squirrel Cage Induction 3 Phase *Splash Proof*

3 to 25 H. Slip Ring Induction 3 Phase *Splash Proof*

30 to 100 HP Slip Ring Induction 3 Phase *Splash Proof*

1 to 7½ HP Repulsion Start Induction Single Phase Brush Lifting *Splash Proof*

1 to 20 HP Capacitor Start Induction Single Phase *Splash Proof* — Capacitor mounted separately on 7½ HP and larger.

1 to 75 HP Direct Current *Splash Proof*

CE-758

Century

SPLASH PROOF MOTORS

Your production is protected by a Century Splash Proof frame that keeps all squirted, spilled or splashing liquids away from the vital working parts of the motor. These motors can be hosed down during your plant clean-up without the slightest damage.

Take a look at the many different types and sizes of Century Motors that are available in Splash Proof frames. Whatever your electric motor requirements, you can specify Century — correctly and with confidence.

Century motors range in size from ⅛ to 400 horsepower — AC, single or polyphase or direct current — with drip proof — splash proof — dust proof — or explosion proof frames. Your nearby Century District Sales office, or a convenient authorized Century Distributor will be glad to give you full information.

Century C MOTORS

CENTURY ELECTRIC COMPANY
1806 Pine Street
St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

★two-mode controllers

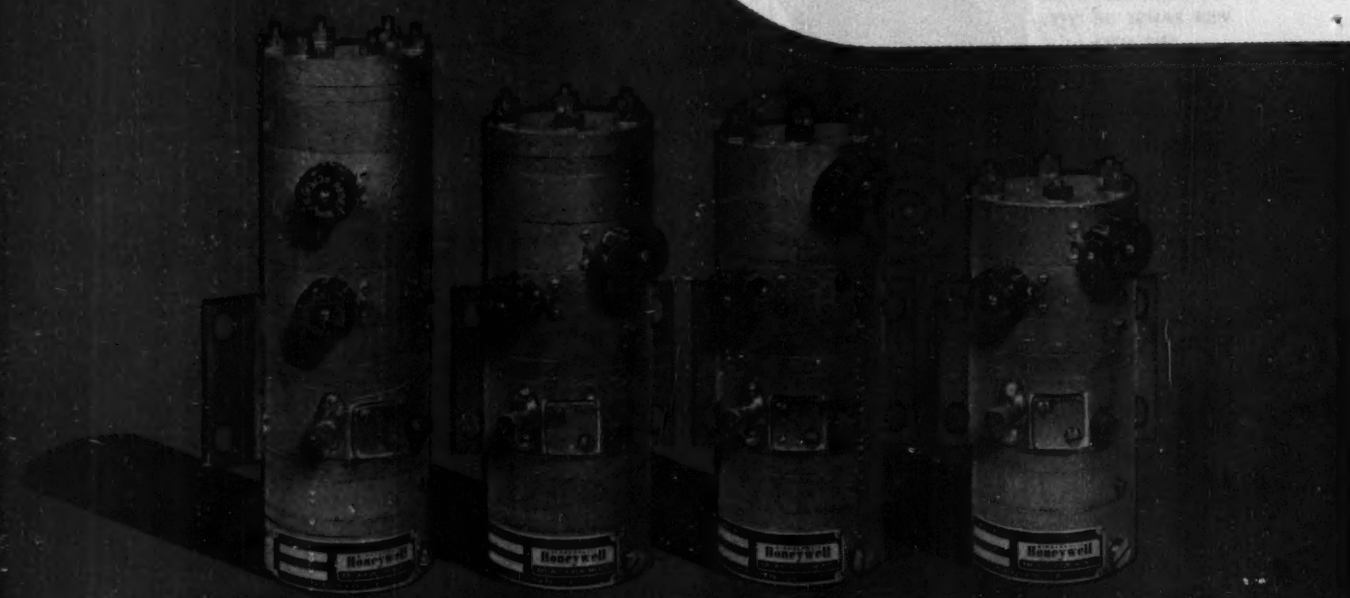
Fixed band plus reset

Amply sensitive for many processes, these models have proportional band set at 150%. Especially designed for flow applications, with reset action adjustable from 0.2 to 100 repeats per minute. Available with or without integral by-pass relay.

★two-mode controllers *(Below)*

Adjustable band plus reset

For processes with short time lags, as well as for many having slow response. Proportional band is adjustable from 2 to 150%. Choice of slow reset type—0.01 to 5 repeats per minute, or fast reset type—0.2 to 100 repeats per minute. Both types available with or without integral by-pass relay.



★three-mode controllers

Proportional plus rate plus reset

The newest additions to the *Tel-O-Set* line, these controllers are applicable to processes with slow response or long time lags . . . such as are often encountered in temperature applications and in certain pressure control work. During automatic start-up, in particular, rate action *prevents* overshooting . . . brings the process in line more quickly and smoothly than simpler control could do.

All three modes are adjustable. Proportional band: 2 to 150%. Reset rate: 0.04 to 20 repeats per minute calibrated range, increasable to about 70 per minute. Rate time: calibrated range 0.02 to 10 minutes; minimum time about ¼ second. Available with or without integral by-pass relay.

Choose a **Tel-O-Set controller** *for the performance* your *job requires*

WHATEVER your specific application may demand in the way of fast-acting pneumatic control, you'll find exactly the right answer in the *Tel-O-Set* controller family. You can select the model that gives the type of control that fits your specifications to a "T" . . . and not be over-sold nor under-equipped . . . but *just right* in economy and performance.

Each of the eight models offers such *Tel-O-Set* features as sealed-tight design, non-bleed pilot valve, simplified tuning, easily-read dial calibrations. Each utilizes the pneumatic balance principle . . . responds instantly to process changes. Dead zone is less than 0.04 psi. Applications cover pressure, liquid level, flow and temperature.

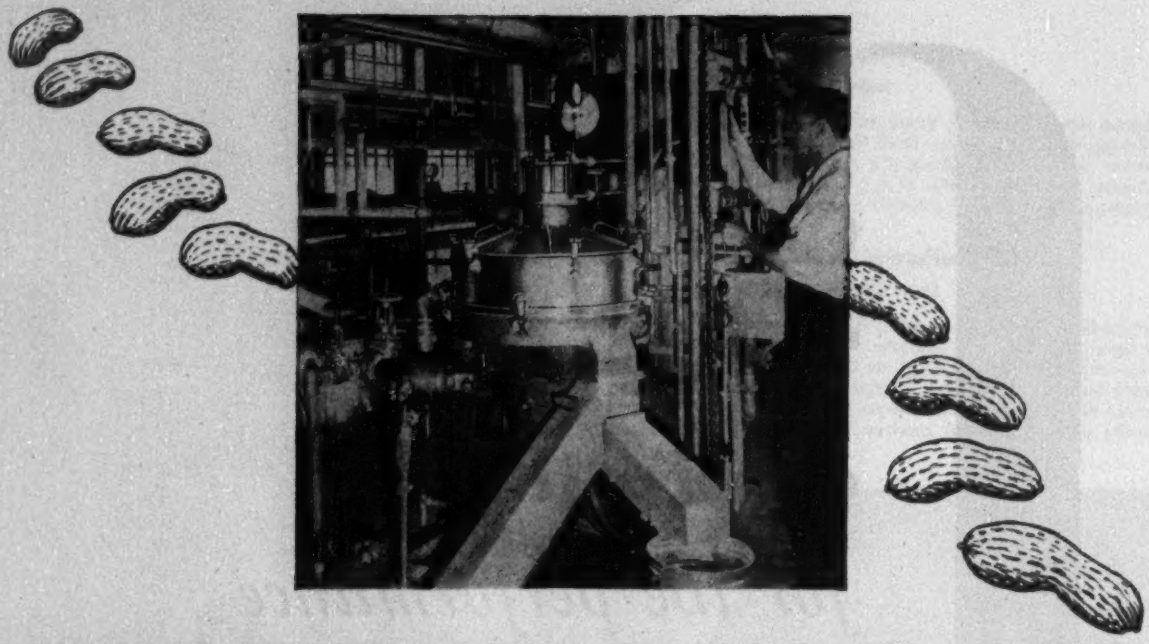
Designed to work with *Tel-O-Set* miniature indicators and recorders, these compact controllers are unaffected by vibration and ambient temperature changes. They need practically no maintenance . . . can have a split manifold to permit removal of the controller while on manual by-pass.

Your local Honeywell engineering representative will be glad to discuss your control applications . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., *Industrial Division*, 4478 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Specification Sheets 768 and 771.**

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls



WHY CENTRIFUGE A PEANUT?

Once a food production exclusively, today the peanut is basic raw material for making many things, including bathing suits and glue. In the pilot plant of the Southern Regional Laboratory, U.S.D.A., when undissolved peanut meal must be separated from peptized protein solution, De Laval centrifuges make the separation easily—and ***continuously.***

Continuous separation by means of centrifugal force is De Laval's business—has been, ever since 1878 in some fields. De Laval centrifuges make separations in seconds that once took minutes or hours. Such centrifuging takes three basic forms:

1. The continuous separation of two liquids.
2. The continuous clarification of one or two liquids.
3. The continuous separation of two liquids plus the continuous removal of solids from one or both liquids.

Call in a De Laval engineer and get the advantage of these many years of experience in each of these three subdivisions of continuous processing.

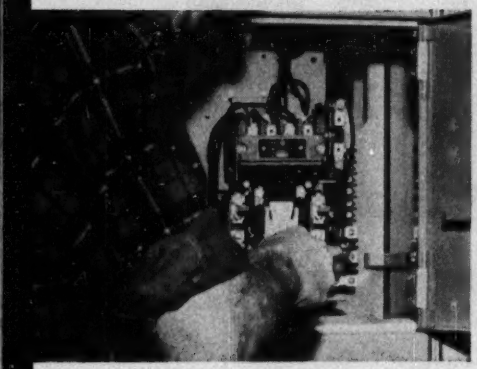
De Laval

THE DE LAVAL SEPARATOR COMPANY

Chicago POUGHKEEPSIE, N.Y. San Francisco

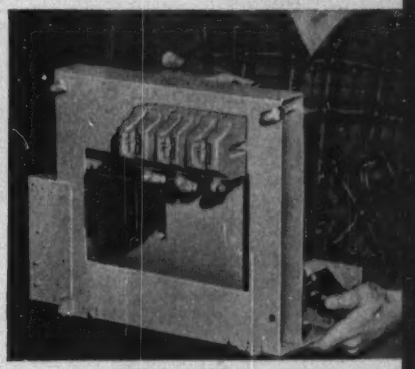
ENGINEERED FOR YOU, the new G-E motor control center is the result of intensive field surveys which told us what industry wants most. It provides maximum flexibility (units easily interchangeable) for central control of a-c motors up to 200 horsepower.

Here are Six Reasons for Specifying the New G-E Motor Control Center

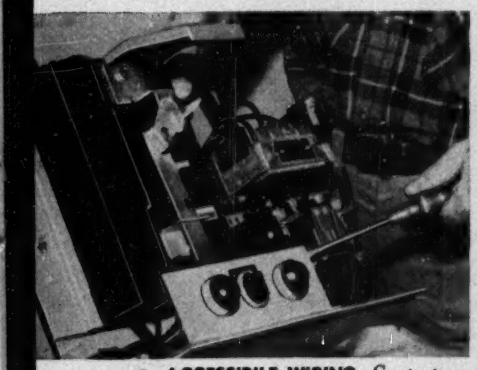


1 FOUR-INCH TROUGH for incoming power lines; terminals in front for easy wiring, maximum accessibility.

2 UNITS EASY TO CHANGE. To remove, disconnect terminals, pull unit out. Units easily changed since *all* components are on unit frame.

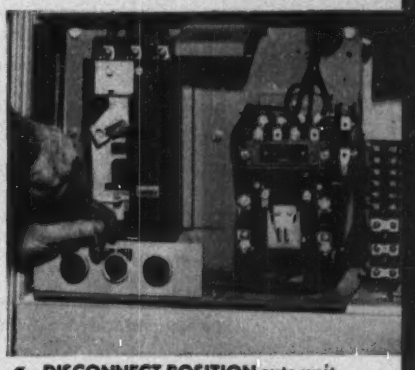


3 LIGHTWEIGHT UNITS are compact and easy to handle. This Size 1 starter unit weighs only 30 pounds.



4 ACCESSIBILE WIRING. Contactors, relays, pushbuttons, and breaker are easily accessible from all four sides.

5 BUS PROTECTED. Steel barrier keeps personnel away from bus. For added safety, compartment doors can be closed while unit is out of compartment.



6 DISCONNECT POSITION cuts unit power off; bus connections made automatically in operating position.

FOR FURTHER INFORMATION, contact your nearest G-E Apparatus Sales Office or authorized G-E distributor, or write Section 781-2 for Bulletin GEA-4979A today. General Electric Company, Schenectady, New York.

You can put your confidence in—

GENERAL ELECTRIC

BENSON ALUMINUM DRUMS

1 Save on replacement costs! Strong, lightweight aluminum drums outlast and outperform shipping containers made of other materials . . . offer tremendous savings on replacement costs alone. They do not rust or shatter. They stand up under rough treatment. In addition, aluminum drums have a high salvage value.

2 Save on labor and material costs! With the elimination of rust problems go the tremendous labor and material expenses of applying inside enamel and sealer coatings . . . baked-on linings . . . rust-proofing . . . re-tinning . . . galvanizing . . . and other costly formulas and preventatives. You can forget drum maintenance and service and use rust-proof Benson Aluminum drums as they are for years and years.

3 Save on shipping charges! To ship a carload of glycerin in heavy-metal drums from Chicago to Philadelphia would cost $558.90 . . . in Benson Aluminum Drums it would cost only $512.95. This saving of $46 means that every eleventh carload is shipped without additional cost. Remember, too, that lightweight Benson Aluminum Drums also reduce handling costs for you and your customers.

4 Save on your chemical investment! Your shipments are safe against rust, contamination and spoilage when they go in rust-proof Benson Aluminum Drums. You eliminate the possibility of costly damage suits and claims. Aluminum drums protect both your shipment and your customer good will . . . and save money and worry.

USE BENSON ALUMINUM DRUMS TO SHIP: Acids, alcohols, aniline, fats and oils, liquid fertilizers, formaldahyde, hydrazine, hydrogen peroxide, inflammables and explosives, insecticides and poisons, premium petroleum products, propellants and many other liquid products. Also, non-regulatory dry chemicals, powdered food products, naval stores, waxes, greases, soaps and other dry solids.

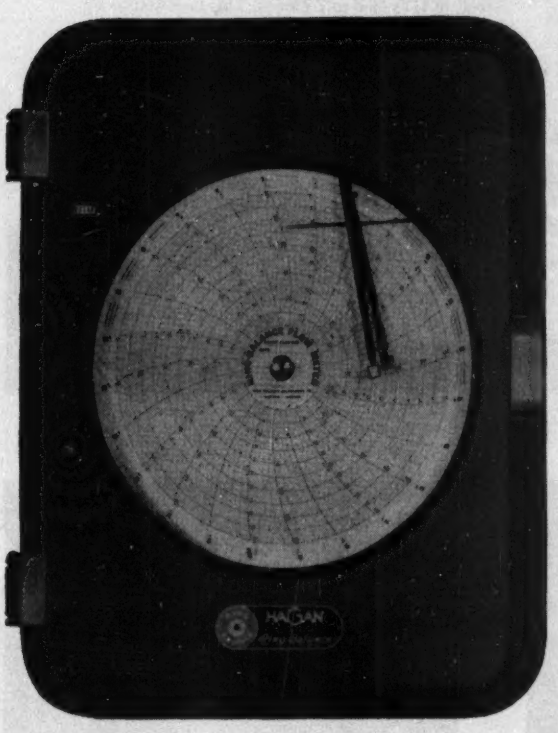
For further information, contact the Reynolds office listed under "Aluminum" in your classified telephone directory, or write direct to Reynolds Metals Company, 2567 South Third St., Louisville 1, Ky.

REYNOLDS ALUMINUM

EXCLUSIVE SALES AGENTS FOR BENSON CHEMICAL DRUMS

For accurate, automatic compensation
for temperature—
for pressure—
for density—or for position

Install Hagan Compensated Ring Balance Meters



The Hagan Compensated Ring Balance Meter automatically adjusts pressure differential or flow readings to correct for variations in temperature, pressure, density or mechanical positioning.

For flow measurements, the built-in integrator totalizes the corrected flow automatically.

Any measurements, such as drum level, steam flow, or any of the variants such as temperature, pressure, or density may be indicated or recorded on the same chart with the corrected record.

Send coupon for Bulletin M-51.

HAGAN CORPORATION
HAGAN BUILDING, PITTSBURGH 30, PA.
Boiler Combustion Control Systems
Ring Balance Flow and Pressure Instruments
Metallurgical Furnace Control Systems
Control Systems for Aeronautical
and Automotive Testing Facilities

Hagan Corporation
Hagan Building • Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters. I am particularly interested in_____

NAME_____

POSITION_____

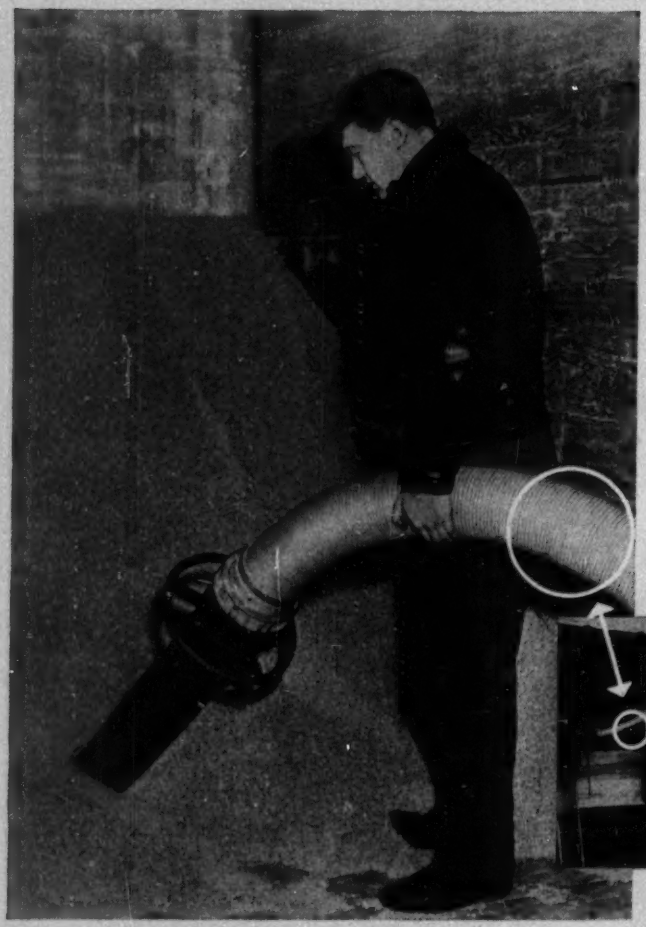
COMPANY_____

STREET AND NUMBER_____

CITY_____ ZONE____ STATE_____

CE-8

News about flexible metal hose and tubing

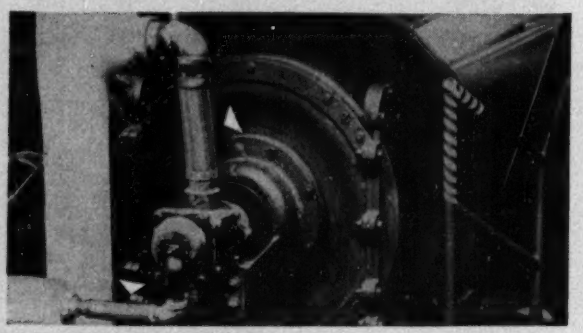


Here are 3 ways they have been used to simplify design, production and maintenance problems

CONVEY GRAIN — Here, American Flexible Metal Hose is used as the conveying line in transfer trucks handling off-the-track bulk shipments in any kind of weather. Holly Pneumatic Systems, Inc. of New York, the manufacturers, use American Type UI tubing in lengths of 20 to 30 feet, in ID's of 6 to 7 inches. This hose stands up under flexings, positions easily and requires little maintenance. If you need a connector that must move, bend or convey liquids, semisolids or gases, American can supply you with a flexible metal hose or tubing of the right alloy.

Holly Pneumatic conveying systems are individually designed for handling a long list of loose bulk materials—cement, cocoa, iron chips, soda ash, and many others.

CARRY STEAM — No more swing joints here! The Chicago, Rock Island & Pacific R. R. Co. uses American Seamless Flexible Metal Tubing to connect railroad terminal steam heating lines. Easy to connect and disconnect, this flexible tubing won't swell or collapse under pressure changes. Use it wherever a leakproof steam connector that must take rough treatment is needed.



CONNECT MISALIGNED PORTS — Where slightly misaligned ports must be connected, American Flexible Bronze Tubing provides the answer . . . as on this Beloit Iron Works paper mill dryer. Here it also dampens vibration and noise and conveys steam. Use American Flexible Metal Hose to connect hard-to-get-at ports. It cuts assembly time and costs, simplifies design.

55214

WRITE FOR CATALOG CC-400: *shows how the tubing is designed, used and installed—gives specifications on tubing and fittings. The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.*

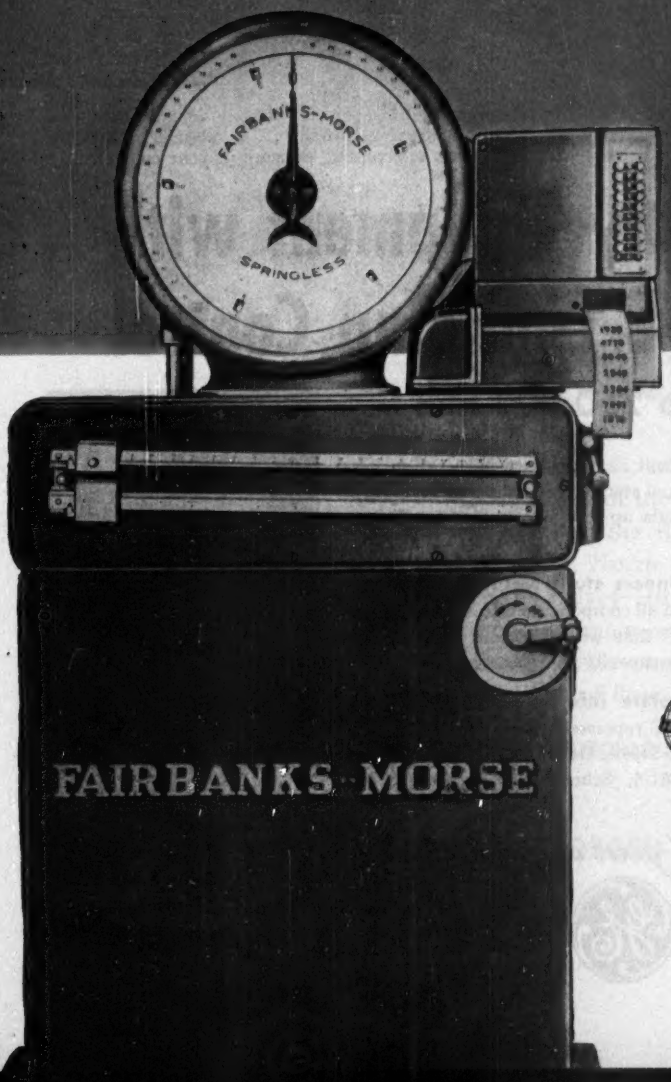
ANACONDA

wherever connectors must move . . . *American* flexible metal hose and tubing

1938
4770
6848
2949
3384
7893
1070

Keep your weights a matter of record

Automatically!



Rule out the chance for weighing errors with a Fairbanks-Morse Dial Scale with Printomatic Recorder. You save annoying, costly receiving and shipping disputes—you have a permanent record of each article weighed *automatically!*

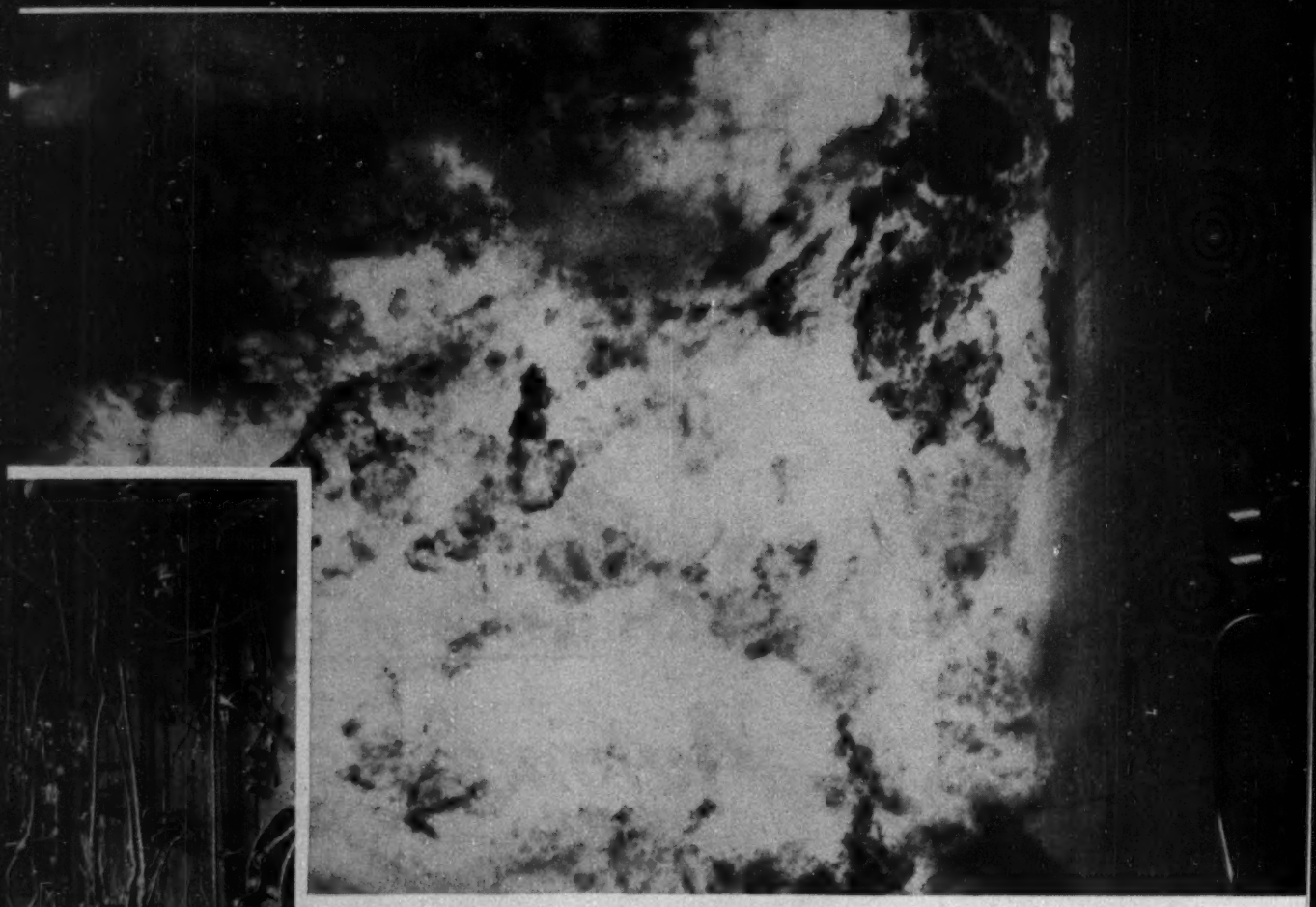
The Printomatic is designed so that other pertinent information may also be printed with the weight for accounting or identification purposes. And, there's an electronic control for materials handling and processing.

See your local Fairbanks-Morse Scale Specialist about the Printomatic Recorder . . . and his complete line of scales of all types. Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the best

SCALES • PUMPS • DIESEL LOCOMOTIVES AND ENGINES
ELECTRICAL MACHINERY • RAIL CARS • HOME WATER
SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS



HERE'S WHAT CAN HAPPEN when you overload your control equipment beyond its maximum interrupting capacity. Luckily this was a test under regulated conditions . . . but this (inset) is what could happen to your equipment with inadequate interrupting capacity in your control.

Protect your costly equipment with High Voltage G-E Limitamp Control

interrupting capacity up to 250,000 kva

Don't take chances on inadequate interrupting capacity. Be sure you have the right controls to protect your equipment and personnel against the possibility of sudden and destructive electrical overloads.

For complete protection against short-circuit conditions up to 250,000 kva specify G-E Limitamp Control, a high voltage motor starter (to 4800 volts) for motors up to 2250 hp.

G-E Limitamp is easy to maintain, simple to operate. Parts can be inspected at a glance . . . fuses are easily accessible in a protected compartment . . . push-button operation permits manual starting and stopping . . . equipment stands up for years under tough conditions.

G-E engineers study your requirements . . . design all components into a co-ordinated "package" that will give you adequate interrupting capacity for your system.

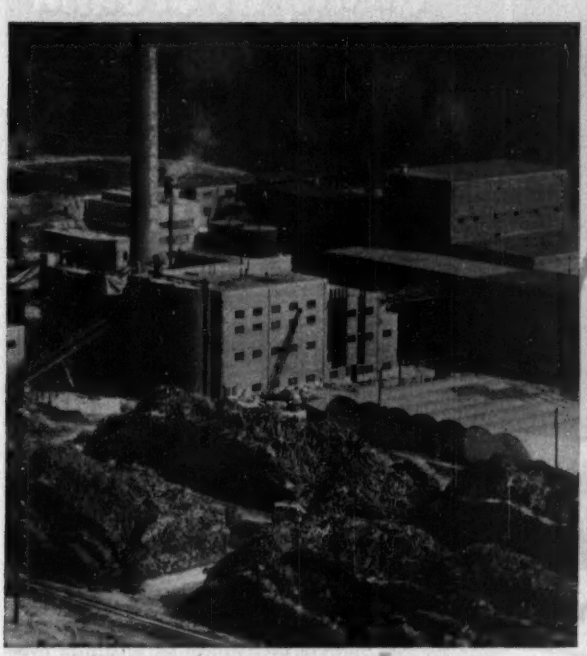
For complete information contact your nearest G-E representative or write for Bulletin GEA-5409A, General Electric Company, Section 781-4, Schenectady 5, New York.

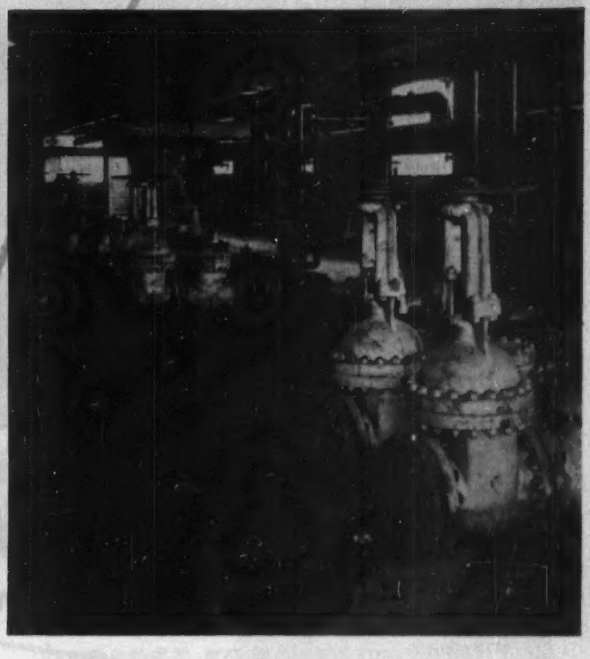
G-E Limitamp Control

You can put your confidence in—

GENERAL ELECTRIC

Oh, I see





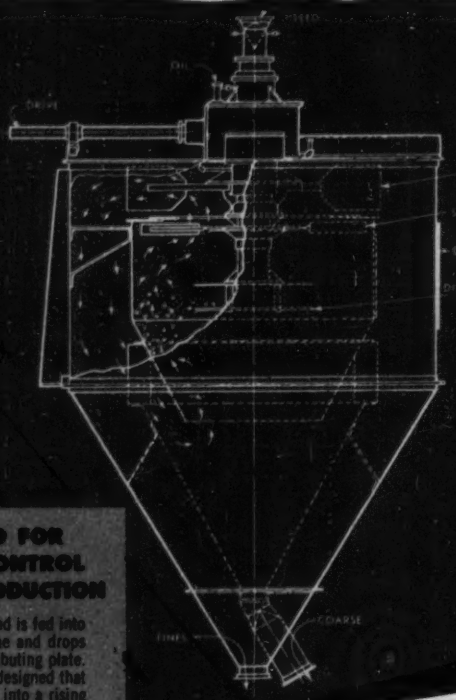
. . . they're using our valves at Riegel Carolina . . .

OIC iron valves, steel valves, bronze valves—you see hundreds of them all through this amazing new plant of the Riegel Carolina Corporation near Acme, North Carolina. The OIC Long Line of Valves—proved dependable in years of similar service—enabled Piping Equipment Company of Greensboro, North Carolina, to meet every kind of flow problem in this pulp mill.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1893

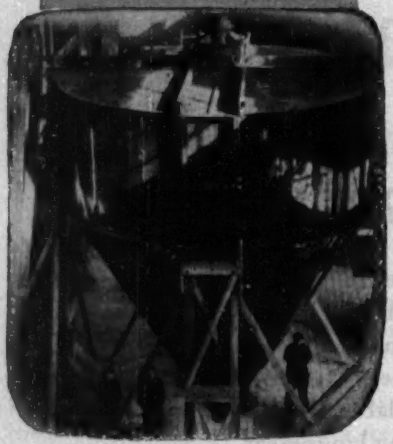
VALVES . . . FORGED & CAST STEEL, IRON & BRONZE



More Accurate Sizing Of Ground And Pulverized Materials!

ENGINEERED FOR PRECISION CONTROL AND HIGH PRODUCTION

Material to be classified is fed into the top of the machine and drops onto a revolving distributing plate. This distributor is so designed that it sprays the material into a rising air current which entirely surrounds the plate. The finer particles are lifted by the air stream and the coarse particles drop down to the rejects spout. Passing up through the separating chamber, the dust-laden air is given a whirling motion between Spinner blades and any remaining oversize particles are precipitated. The separator is adjustable to control the fineness of the finished product with unusual accuracy.



18-Foot Williams RC Separator being tested at plant before shipment.

WILLIAMS MECHANICAL AIR SEPARATORS For Finenesses From 30 to 325 Mesh

- Most efficient mechanical air separator ever developed for classifying ground and pulverized materials, or for removing fines from dry ground materials before classifying.
- Product quality is vastly improved and output considerably increased when operated in closed circuit with virtually any type of mill.
- Will handle with equal efficiency a complete range of products—mineral, chemical and vegetable—from the hardest, most dense limestone and ore to the softest, fluffiest starches and flours.
- Permits coarser settings in grinding equipment thus lengthening equipment life by reducing wear on all moving parts. Power consumption is much lower.
- Extra heavy construction. Equipped with anti-friction bearings encased in dust-proof and moisture-proof housings. All casings are of heavy steel plate construction. Operation is dustless and repair cost is practically nil, since there are no fine sieves to wear out and the heavy construction insures long life.

9 Standard sizes, 2½ to 18-foot diameters — Capacities from 500 lbs. to 75 tons hourly

Write For Details And Describe Your Operation

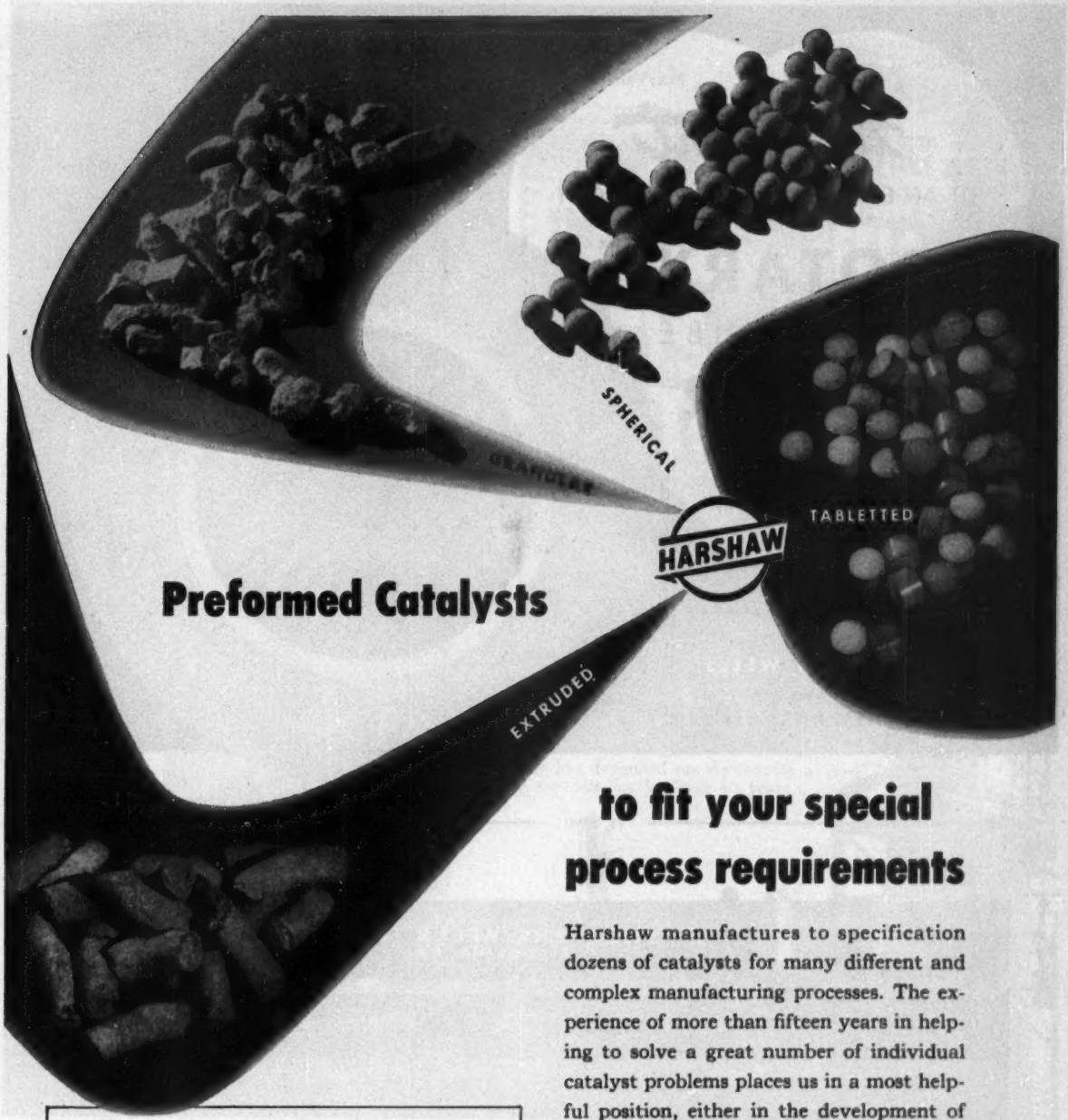
WILLIAMS PATENT CRUSHER & PULVERIZER CO.

2706 NORTH NINTH • ST. LOUIS 6, MO.

WILLIAMS

CRUSHERS GRINDERS SHREDDERS

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD



Preformed Catalysts

to fit your special process requirements

Harshaw manufactures to specification dozens of catalysts for many different and complex manufacturing processes. The experience of more than fifteen years in helping to solve a great number of individual catalyst problems places us in a most helpful position, either in the development of the best and most economical catalyst, or in qualifying with large production capacity requirements. If you have a problem, perhaps a discussion with us will prove helpful.

SEND FOR *this 8-page booklet on Harshaw Catalysts*

PROCESS

Hydroforming	Cyclization	Oxidation
Dehydrogenation	Dehydration	Desulphurization
Alkylation	Isomerization	Hydrogenation

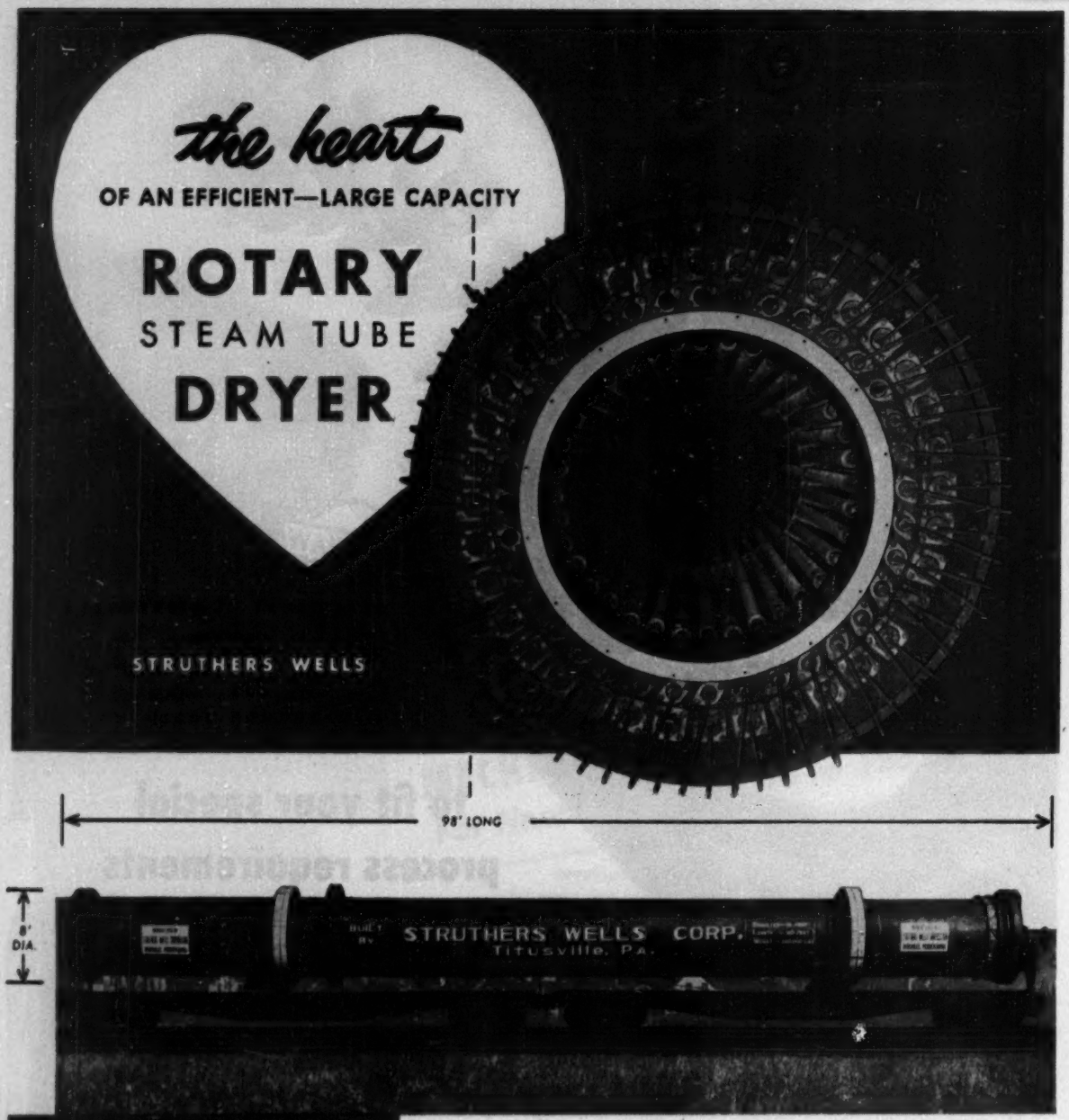
TYPICAL CATALYSTS

Aluminum Chloride Anhydrous
Boron Fluoride Addition Compounds
Boron Trifluoride
Hydrofluoric Acid Anhydrous

Alumina Chrome Alumina Molybdena Alumina
Tungsten Alumina Cobalt Copper
Magnesia Nickel Vanadium

BRANCHES IN PRINCIPAL CITIES

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio



Struthers Wells

The striking illustration above is an end view of a recently completed rotary steam tube dryer with the housing removed to show the piping manifold connecting ends of the finned tubes. Note that the three layers of steam tubes are carefully supported and provide for expansion—a most efficient construction for this type of heavy duty dryer.

Two railroad cars were required to transport this 8' dia. x 98' long unit—supported on two large tires and double trunnion roller bases. A third car was used to ship the end housings, trunnion bases and gear drive.

This large steam tube dryer is an excellent example of Struthers Wells experience and facilities to produce specialized equipment to meet your specific production requirements.

STRUTHERS WELLS CORPORATION

PROCESS EQUIPMENT DIVISION • TITUSVILLE, PA.

Plants at Titusville and Warren, Pa. • Offices in Principal Cities

Dependable Source for Chemical Raw Materials

WYANDOTTE CHEMICALS

FELS . . .

a fine familiar name in SOAPS since 1876.

HAROLD G. PILE

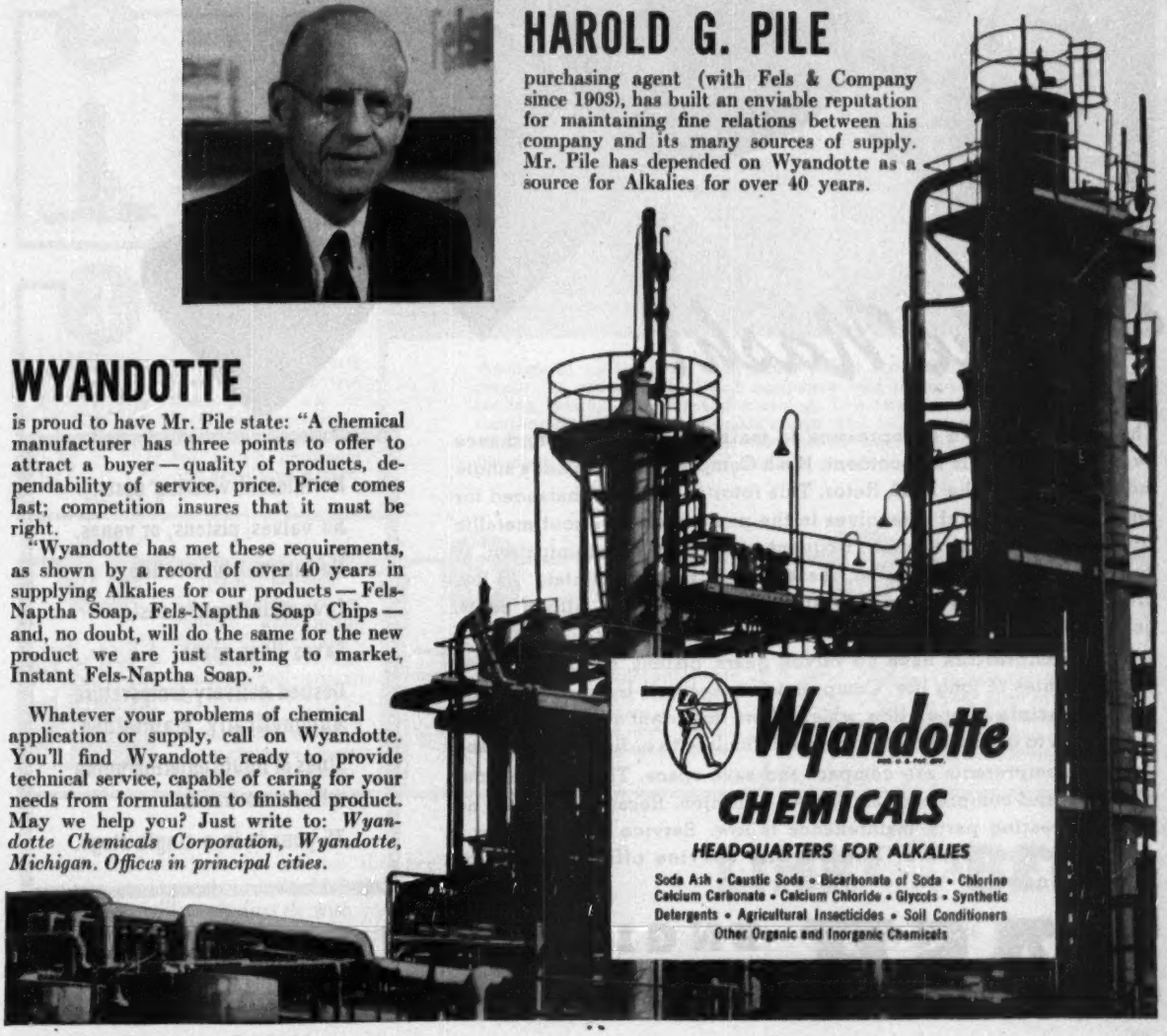
purchasing agent (with Fels & Company since 1903), has built an enviable reputation for maintaining fine relations between his company and its many sources of supply. Mr. Pile has depended on Wyandotte as a source for Alkalies for over 40 years.

WYANDOTTE

is proud to have Mr. Pile state: "A chemical manufacturer has three points to offer to attract a buyer — quality of products, dependability of service, price. Price comes last; competition insures that it must be right.

"Wyandotte has met these requirements, as shown by a record of over 40 years in supplying Alkalies for our products — Fels-Naptha Soap, Fels-Naptha Soap Chips — and, no doubt, will do the same for the new product we are just starting to market, Instant Fels-Naptha Soap."

Whatever your problems of chemical application or supply, call on Wyandotte. You'll find Wyandotte ready to provide technical service, capable of caring for your needs from formulation to finished product. May we help you? Just write to: *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*



Wyandotte

CHEMICALS

HEADQUARTERS FOR ALKALIES

Soda Ash • Caustic Soda • Bicarbonate of Soda • Chlorine
Calcium Carbonate • Calcium Chloride • Glycols • Synthetic Detergents • Agricultural Insecticides • Soil Conditioners
Other Organic and Inorganic Chemicals

It's the Nash!

The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

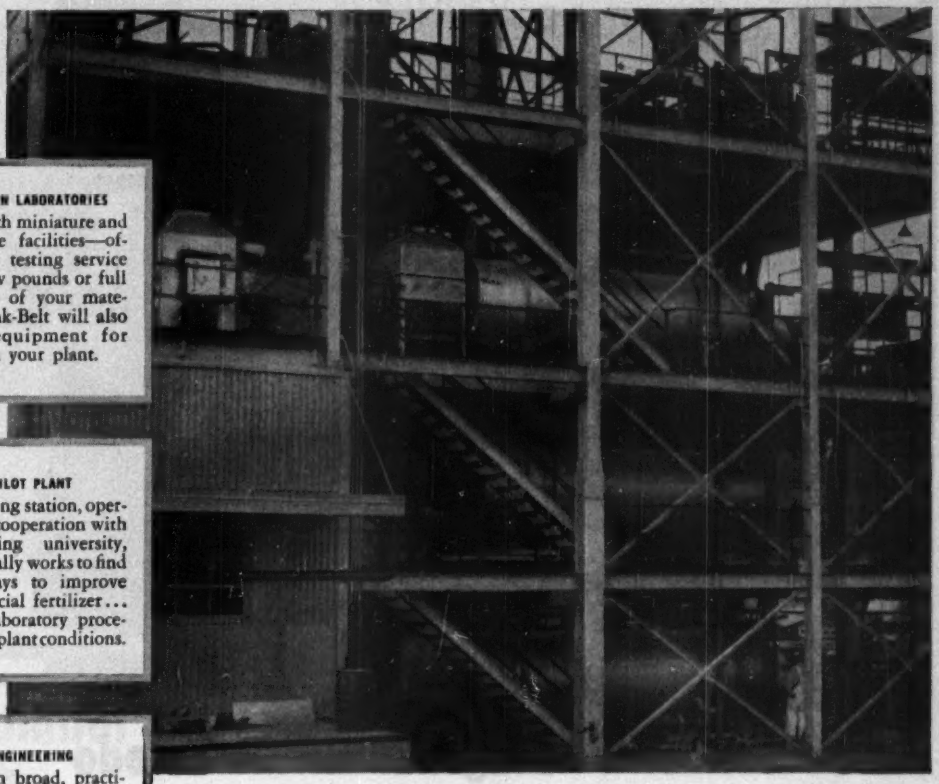
Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature Automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.

Planning a fertilizer plant?

LINK-BELT offers a 6-point "turn-key" service--a unified responsibility for complete plants

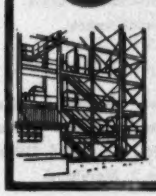


1 **MODERN LABORATORIES** have both miniature and full-scale facilities—offer free testing service on a few pounds or full carloads of your material. Link-Belt will also lease equipment for work in your plant.

2 **PILOT PLANT** and testing station, operated in cooperation with a leading university, continually works to find new ways to improve commercial fertilizer... adapt laboratory procedures to plant conditions.

3 **ENGINEERING** based on broad, practical experience, assures better equipment that often permits use of lower cost ingredients. Other developments have reduced processing time, saved storage space.

4 **LINK-BELT EQUIPMENT** This includes dryers, coolers, granulating drums, disintegrators, continuous mixers, ammoniators, roll crushers, all types of conveyors and elevators, vibrating screens and a complete line of chains and power transmission machinery.



5 **SKILLED ERECTION CREWS** can be furnished by Link-Belt. Link-Belt experience includes dry-mix, superphosphate, nitrophosphate, ammonium nitrate, ammonium sulphate, urea, granulation and other plants.

6 **SATISFACTORY PERFORMANCE** When you rely on Link-Belt as a single source, Link-Belt accepts responsibility for placing your plant in full operating readiness. We will also supervise modernizing existing plants.

Ammonium nitrate plant, shown here before completion of building, reveals the variety of Link-Belt equipment used in conveying, drying, cooling, mixing, elevating and screening. This large southern chemical company obtained a fully integrated system. And, because Link-Belt makes a broad line of such equipment—they got the specific unit best-suited to the exact requirements of their particular process.

To find out how this unique "turn-key" service can serve you, get in touch with the Link-Belt office near you. Our engineers will work directly with you or your consultants . . . help you produce better fertilizer at lower cost.

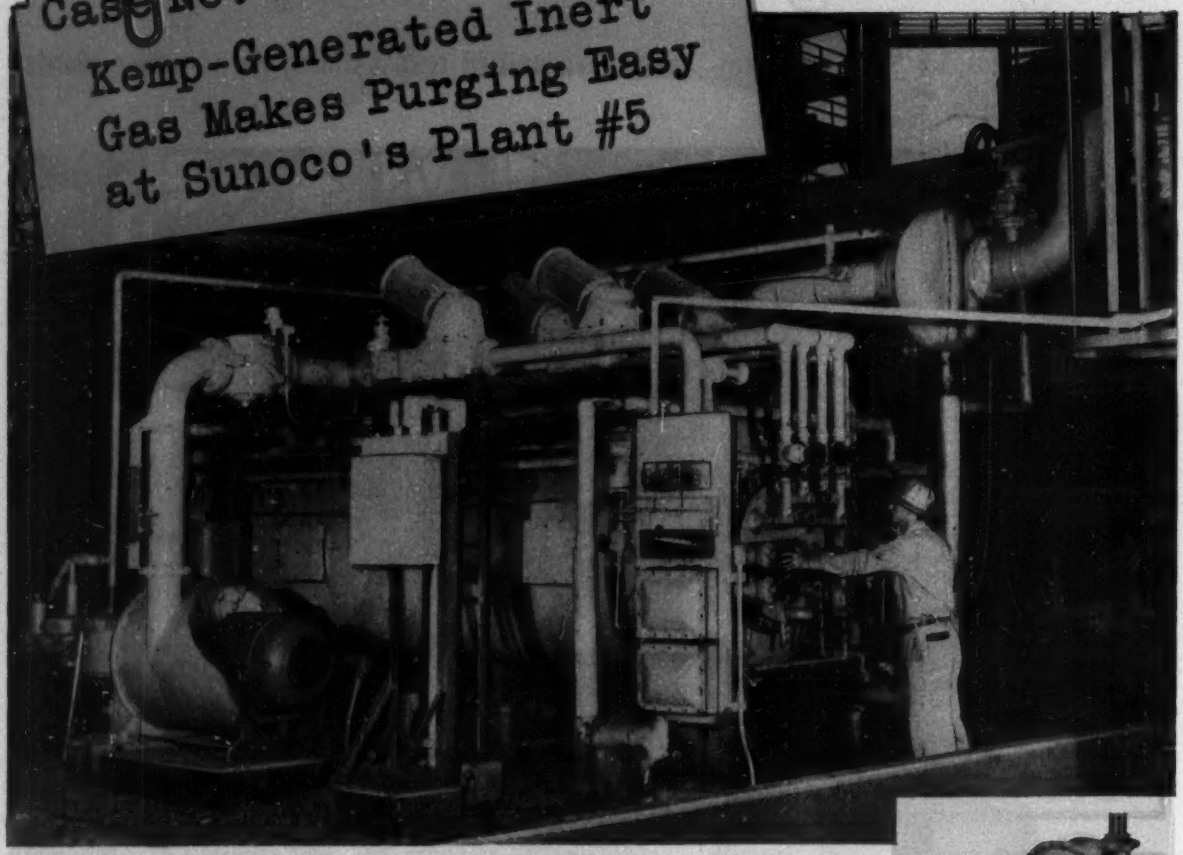
LINK-BELT

CONVEYING AND PROCESSING EQUIPMENT

12,251-A

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle; Scarboro, Toronto and Elmira, Ont. (Canada); Springs (South Africa); Sydney (Australia). Sales Offices in Principal Cities.

Case No. 57
Kemp-Generated Inert Gas Makes Purging Easy at Sunoco's Plant #5



How Sun Oil's "Magic Mill" at Toledo operates with 'round the clock safety

There's no *one* word that strikes terror in the hearts of oilmen everywhere more quickly than F-I-R-E! To combat this threat at the Sun Oil Co.'s giant refinery at Toledo, Ohio, constant vigilance, checks and inspections are the answer. And the liberal use of inert gas for purging pipelines, tanks and crackers is essential to this safety maintenance.

Kemp selected to do the job

When plans called for *doubling* plant production in 1950, a new Kemp Generator (see above) was installed to insure adequate inert gas production. Fast-starting, easy-to-operate, this Kemp unit more than filled the bill. Today tanks and lines are periodically purged for inspection and cleaning *as often as needed*. And thanks to its 60,000 cu. ft. per hr. Kemp Inert Gas Generator, Sunoco enjoys *exact analysis* inert production that meets all its purging requirements.

Let Kemp help you, too

If you have a purging or blanketing problem, why not let Kemp Engineers give you the same helpful advice used so profitably at Sun Oil's Toledo refinery. It costs you nothing to investigate. And it may save you money. Find out how Kemp's wide range of dependable, low-cost Generators (complete with the latest fire checks and safety devices) offer you the best way to solve your problems.

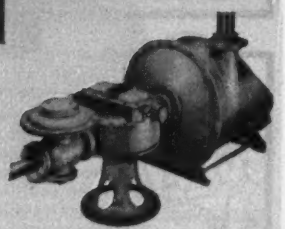
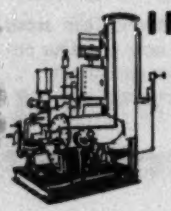


Photo above shows close-up view of Kemp Industrial Carburetor, the heart of every Kemp installation. Assures complete combustion... without waste, without tinkering. Reduces installation costs, simplifies maintenance.

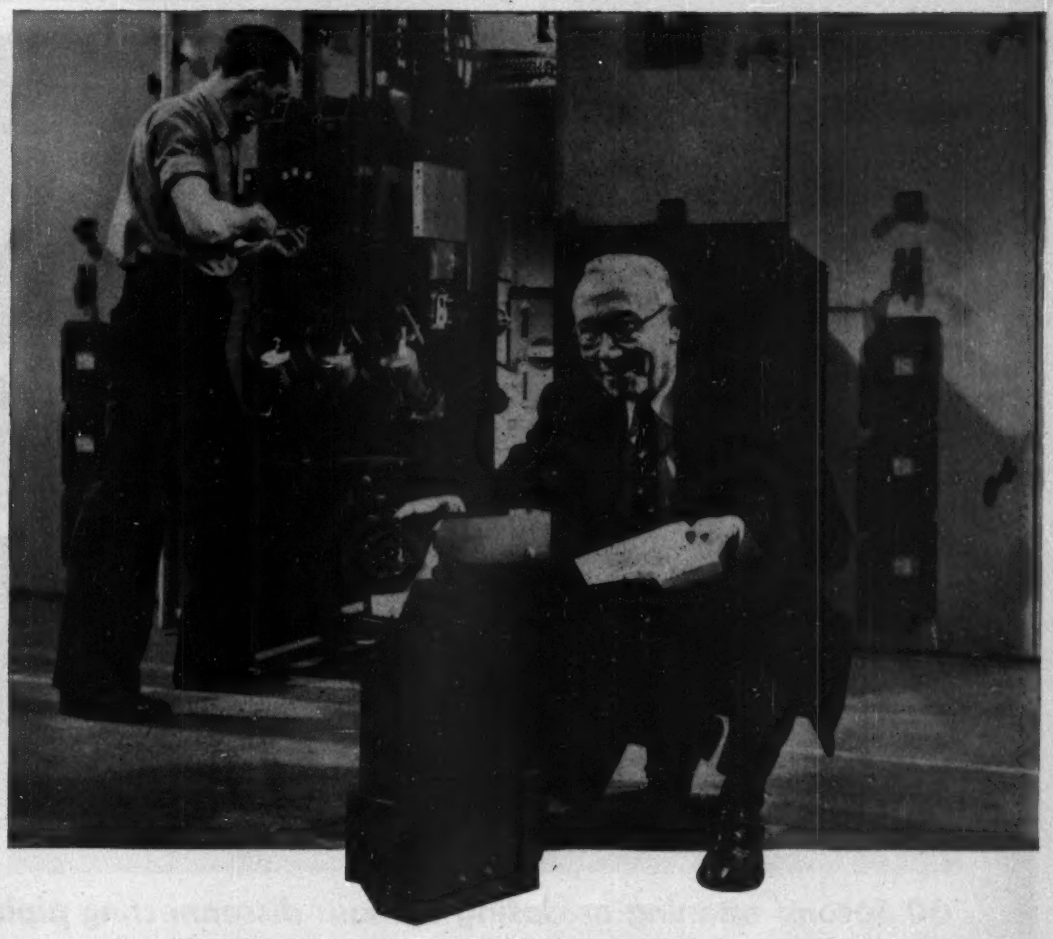
For more complete facts and technical information, write for Bulletin I-10 to: C. M. KEMP MFG. CO., 405 E. Oliver Street, Baltimore 2, Maryland.

KEMP OF BALTIMORE



INERT GAS GENERATORS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • ADSORPTIVE
DRYERS • SINGEING EQUIPMENT



How we combat corrosion and searing arcs

In most industrial plants, metal-clad switchgear is under constant attack—inside and out. To protect against the effects of arcing, Westinghouse lines arc chutes with a true ceramic containing a high percentage of *zircon,* which has the highest melting point of any known material.

Additional important factors in chute life that maintenance men appreciate: Westinghouse chutes will not absorb moisture, have dielectric properties comparable to porcelain.

This switchgear employs the most effective method of arc extinction in use today. The arc is extinguished in split seconds and it is on the main contacts for only a fraction of this time. Result: less contact burning, less chute wear, less shock to the whole unit.

Bonderizing® best practical surface protection

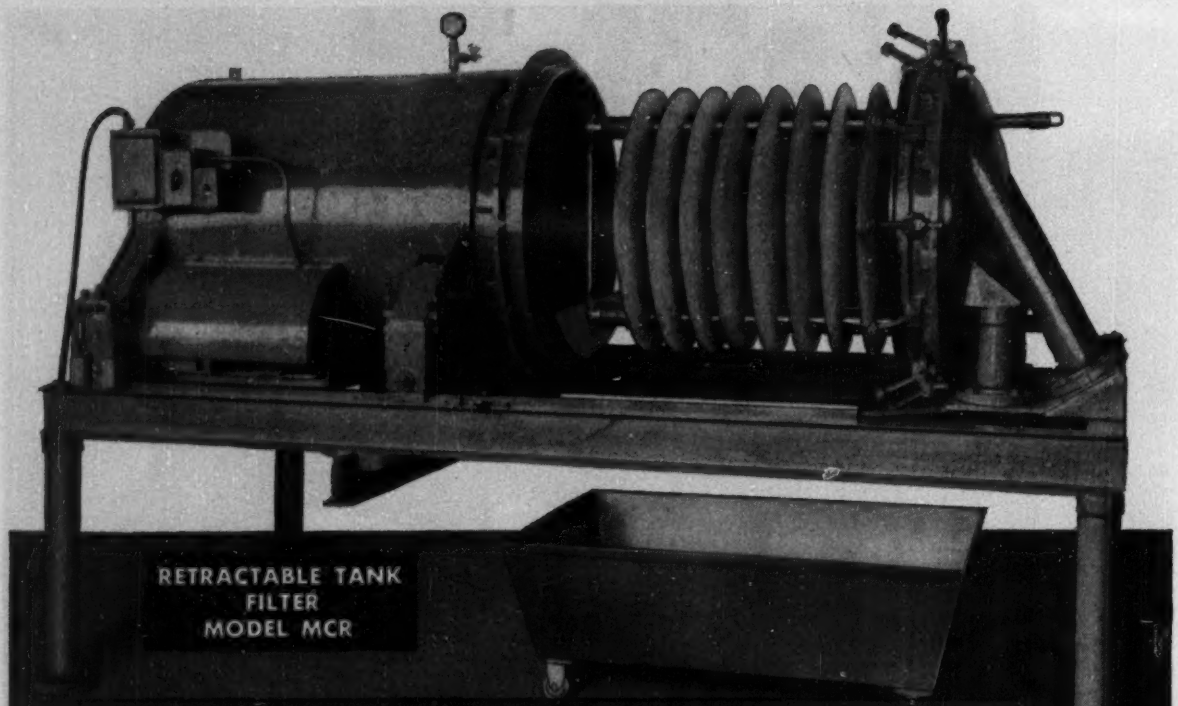
The best practical metal surface protection that we know of for switchgear is Bonderizing. We Bonderize our metal enclosures *after* they're assembled so that every nook and cranny gets the full five-dip treatment. Then the enclosures are painted twice and the paint sticks as though it is part of the metal.

In Westinghouse outdoor switchgear there's no worry about corrosion on the undersurfaces, either. After assembly, we spray them with a heavy layer of rubberized coating.

When you're planning switchgear installations, call in Westinghouse. And write now for your copy of booklet B-5306. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-60820-C

YOU CAN BE SURE...IF IT'S Westinghouse



A NEW FAST OPENING, HEAVY DUTY FILTER by SPARKLER

60 Second opening or closing without disconnecting piping. Available in sizes from 100 to 2000 sq. ft. filtering area.

This new retractable tank model MCR filter opens up a new phase in filtering that will lower the cost materially in many industrial fields.

One movement of a handle releases all head bolts simultaneously, a flip of a switch and the retractable tank moves back, stopping automatically, leaving the plates exposed for hand cleaning. All in less than 60 seconds. Pipe connections are all in the stationary filter head so no disconnecting of piping is necessary. This gives you the fastest action, time-saving, labor-saving tank opening ever engineered in a filter.

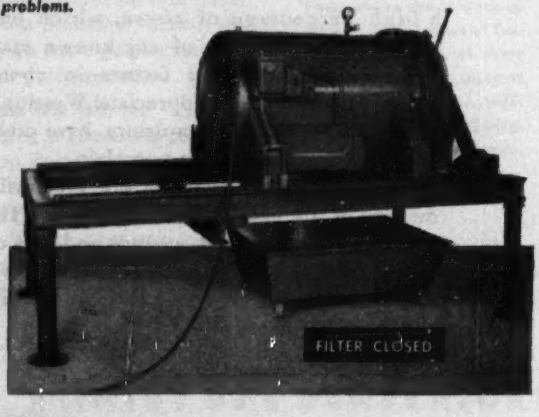
Jet spray tubes can be supplied in this filter with automatic breaking head seal for water supply. With the jet spray the cake can be washed off with pressure spray, backwashed, or a combination of jet-spray and backwashing employed for cleaning the plates.

The retractable tank Model MCR Filter fills the need for a large capacity filter that can handle heavy residue fluids and for removal of large percentage solids. The plates can be spaced any distance apart to accommodate a heavy or thin cake depending on requirements.

The circular double surface screen plates are reinforced to withstand extremely high filtering pressure without danger of collapsing.

Filter tanks can be supplied in mild steel, stainless steel, or other metals to meet chemical requirements. Tanks can be rubber lined or plastic lined for corrosion resistance. Each filter including valves and piping is engineered to perform the job required.

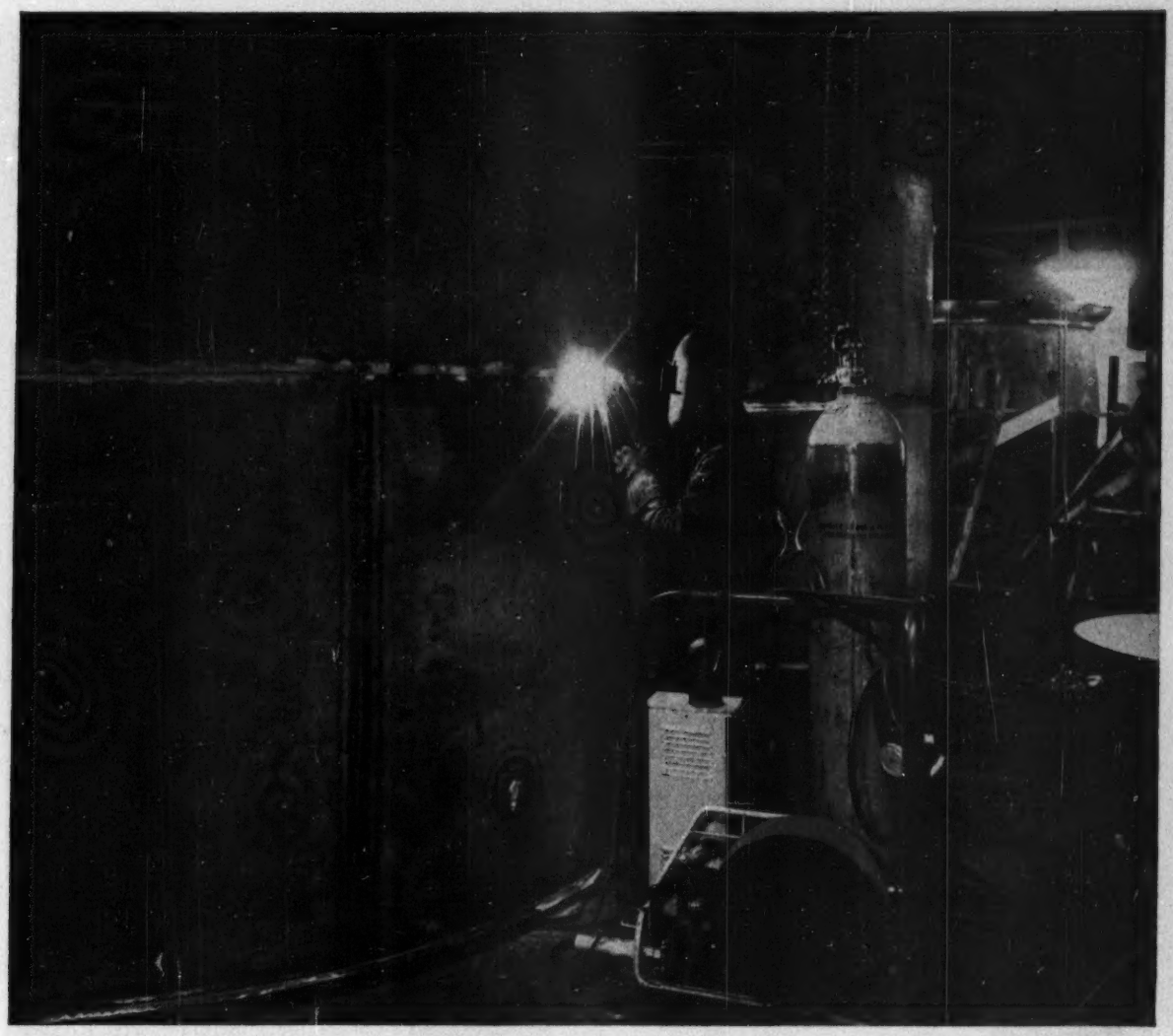
Write for specific information about this new filter pertaining to your particular product. Personal attention will be given to your filtering problems.



SPARKLER MANUFACTURING COMPANY • MUNDELEIN, ILLINOIS

Sparkler International Ltd.
Prinsengracht 876, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill., U.S.A.



EASY TO WELD WITH EVERDUR. These 15'-6" diam. x 10'-4" high brewery hot water storage tanks fabricated of 3/16" Everdur sheet by Ellett Copper & Brass Co., Ltd., in Vancouver, B. C. Inert-gas-shielded metal-arc method of welding used 1/16" Everdur Rod.

Brewery defeats rust with Everdur tanks – cuts welding costs, too.

Each of these Everdur* tanks will hold 15,000 gallons of hot water for making beer in the new plant of Sicks' Capilano Brewery, Ltd., at Vancouver, B. C. It's another tribute to the rust-proof, corrosion-resistant properties of these ANACONDA Copper-Silicon Alloys that have long been favorite materials for process industry equipment.

In addition to its corrosion resistance and complete immunity to rust, Everdur has the very practical property of being one of the easiest of structural metals to fabricate. These tanks are shown being welded with Everdur Rod by the inert-gas-shielded metal-arc method. This method produces sound welds with all the strength of the base metal at low cost and high speed.

Everdur is but one of the ANACONDA family of copper alloys which offer a wide range of physical properties and forms for designing process industry equipment. If high corrosion resistance, freedom from rust, low fabrication costs and high strength are requirements of your equipment, let us tell you more about Everdur and other ANACONDA Copper Alloys and their fabrication methods. Just write to the Technical Department of *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.* 8121

*Reg. U. S. Pat. Off.

EVERDUR

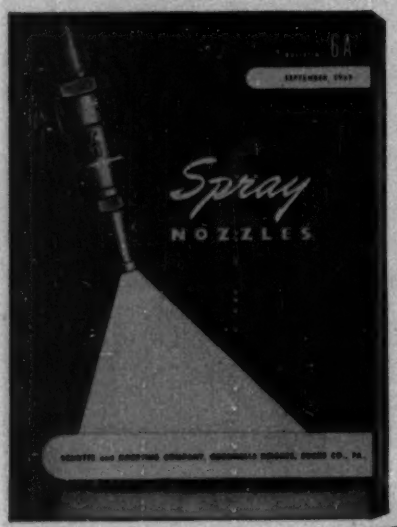
ANACONDA®

COPPER-SILICON ALLOYS

STRONG · WELDABLE · WORKABLE
CORROSION-RESISTANT

SK News

New SK Bulletin Simplifies Selection of Spray Nozzles



Bulletin 6-A—just issued—contains detailed, concise information on the many types of Spray Nozzles manufactured by SK. It was designed to enable industrial buyers to specify the right nozzle to meet application requirements.

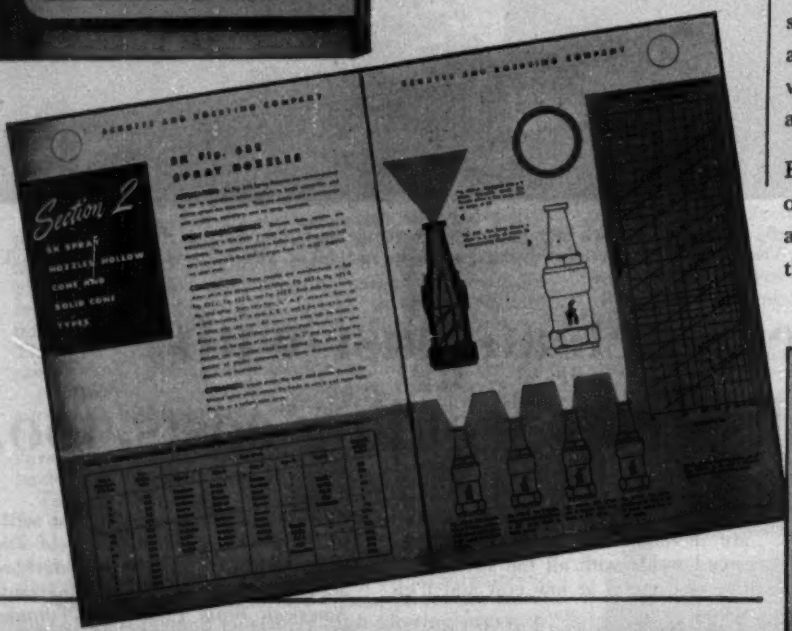
A tabular index in the front of the catalog lists each nozzle by number and gives its primary application, spray characteristic, materials of construction and the page showing detailed description.

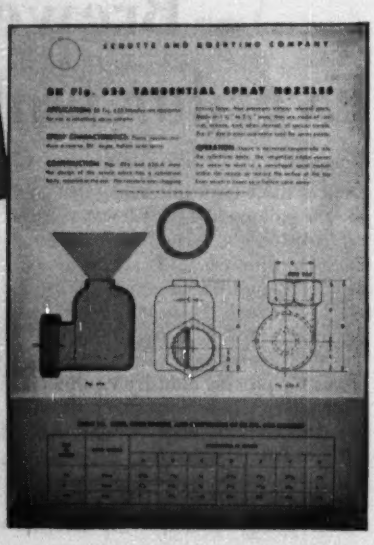
For ready reference, Atomizing Nozzles, Spray Nozzles and Spray Nozzle Clusters are treated in separate sections.

Construction, spray characteristics and capacities are given for each type of nozzle, and differences in design or materials of construction are noted. Descriptive material and illustrations are supplemented by dimension tables and capacity charts.

SK Spray Nozzles are widely applied in mixing, coating, cooling and scrubbing processes. Other typical applications range from atomizing, washing, and aerating liquids to absorbing gases.

Bulletin 6-A is made up of 20 pages of complete, useful material. Request a copy for your files. It's yours for the asking.





Manufacturing Engineers

free!

send for this valuable brochure today and learn the scientific facts about TAR BASES – their applications, properties, performance and potentialities.

This handsome 96-page brochure belongs on the desk of every man whose business uses Tar Bases. More than a catalogue, "Barrett Tar Bases" is an up-to-the-minute reference work on one of the fastest developing fields in industrial chemistry. Subjects include:

USES OF TAR BASES in the pharmaceutical industry... as stabilizers in vapor degreasing . . . in plastics industry and polymer technology . . . in the petroleum, cellulose, textile, dye, and pesticides industries . . . in metal cleaning operations . . . as denaturants . . . other varied uses. Includes bibliographical abstracts to facilitate research.

PROPERTIES OF PURE TAR BASES—physical constants, thermodynamic constants, solubility data, azeotropic mixtures, vapor pressures, viscosity data, spectra.

TYPICAL REACTIONS OF PURE TAR BASES—addition compounds, halogenation, nitration, oxidation, hydrogenation, sulfonation, hydroxylation, amination, alkylation, arylation and condensation.

TEST METHODS—specific gravity, water content, distillation, residue, oil content, color, preparation of color standards, limpid point, quinoline content.

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Barrett®

BARRETT DIVISION

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In Canada: The Barrett Co., Ltd., 5551 St. Hubert St., Montreal, Que.

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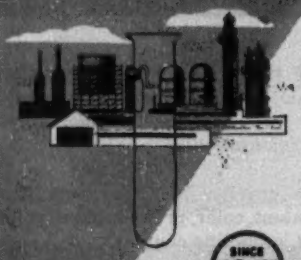
PROTEX WATERPROOF PAPER LINED BAGS

for the Chemical Industry



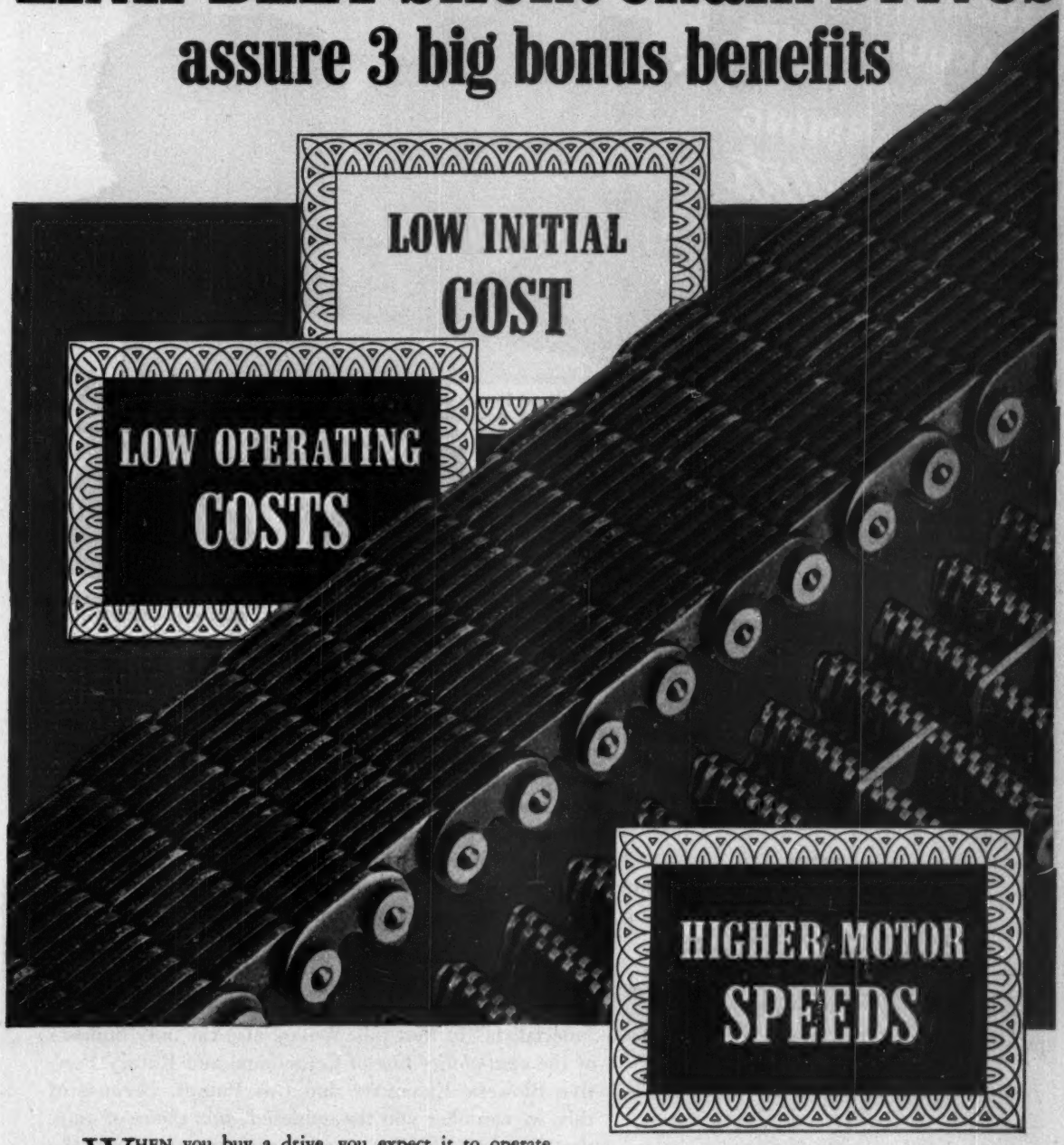
Complete protection of your product
plus attractive appearance
... the result of
over 100 years experience
in designing and making bags.

SINCE 1847

CHASE BAG COMPANY

GENERAL SALES OFFICES 309 W. JACKSON BOULEVARD
CHICAGO 6, ILLINOIS
30 BRANCHES AND SALES OFFICES STRATEGICALLY LOCATED

LINK-BELT Silent Chain Drives
assure 3 big bonus benefits



WHEN you buy a drive, you expect it to operate efficiently throughout its entire life. And with Link-Belt Silent Chain, you're assured of better than 98% *sustained* efficiency throughout its many years of service! What's more, these positive, no-slip drives are low in first cost . . . low in operating costs. And, with their ability to operate at higher speeds, you can reduce your investment in motors and controls. Link-Belt Silverstreak Silent Chain Drives are available from fractional to thousands of hp. You can obtain ½ to 50 hp drives (ratios of 1:1 to 7:1) from stock. Get complete information from your Link-Belt sales office or distributor.

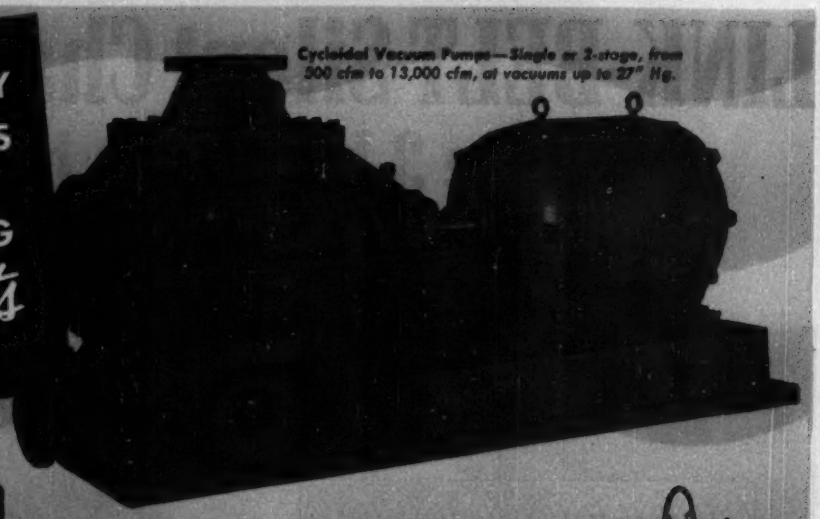
LINK-BELT

SILVERSTREAK SILENT CHAIN DRIVES

13,342

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities.

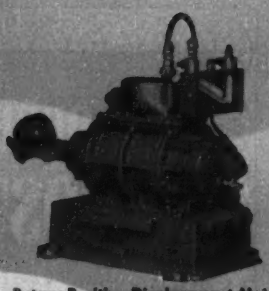
HIGH-EFFICIENCY VACUUM PUMPS BUILT BY AIR HANDLING *Specialists*



Cycloidal Vacuum Pumps—Single or 2-stage, from 500 cfm to 13,000 cfm, at vacuums up to 27" Hg.

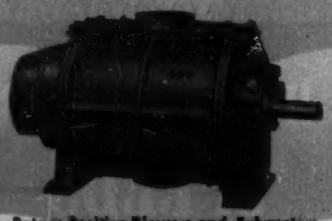
Inert Gas Generators Portable or stationary, from 1,000 cfh to 35,000 cfh.

Centrifugal Blowers and Exhausters Single and multi-stage, from 2,000 cfm to 100,000 cfm or higher.



Rotary Positive Displacement Meters 4,000 cfh to 1,000,000 cfh.

Rotary Positive Gas Pumps 5 cfm to 50,000 cfm.



Rotary Positive Blowers and Exhausters 5 cfm to 50,000 cfm.

The wide acceptance of R-C Vacuum Pumps is the result of extremely low cost for power and water, and proved long-time reliability of these simple rotary positive units. Further, because they operate at higher speeds (600 rpm and above), they require smaller motors, less floor space and lower foundation cost. This naturally reduces initial investment and thus increases the percentage of operation savings.

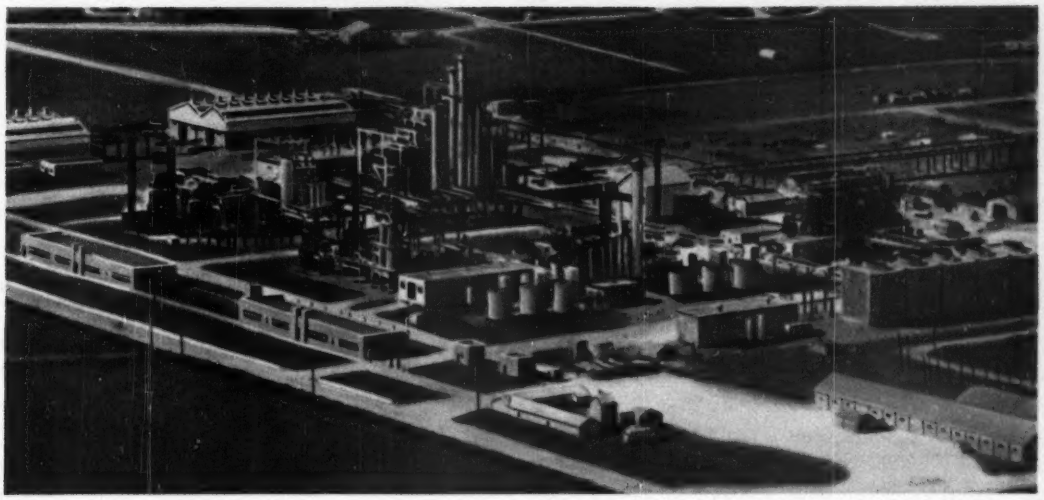
The successful performance of R-C Vacuum Pumps comes from almost a century of experience in handling air and gas. That is our exclusive business — we are "specialists" in that job. We are also the only builders of the *dual-ability* line of Centrifugal and Rotary Positive Blowers, Exhauster and Gas Pumps. Because of this, we can offer you the unbiased, *dual choice* of units that are best fitted to your requirements. And, the wide range of capacities of R-C equipment eliminates oversizing, thus reducing first cost and lowering operating expense.

For your present or future needs, you will get sound advice and competent co-operation by calling on Roots-Connersville specialists in handling gas or air.

ROOTS-CONNERSVILLE

Exclusive Specialists in Handling Gas and Air

ROOTS-CONNERSVILLE BLOWER A DIVISION OF DRESSER INDUSTRIES, INC. 538 Illinois Ave. • Connersville, Indiana

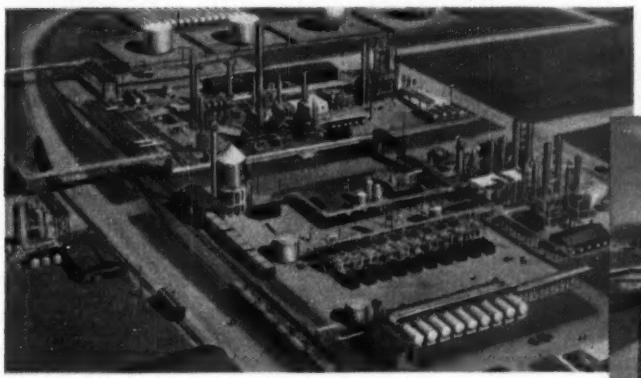


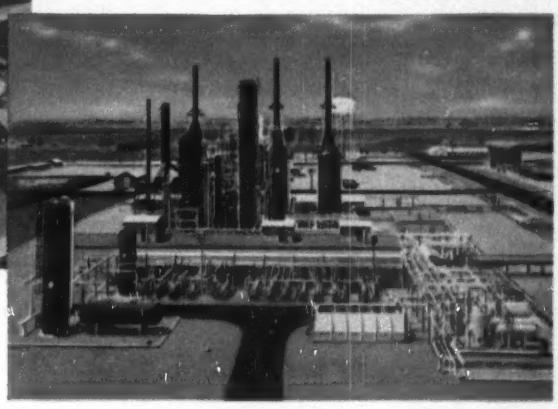
Development Studies *and* Reports

FOR THE NATURAL GAS, PETROLEUM, PETROCHEMICAL AND CHEMICAL INDUSTRIES

Stone & Webster Engineering Corporation, Badger Process Division, has designed and constructed many plants for the process industries to produce intermediate and finished products. Much of this work resulted from development studies and reports made by the Corporation, which included consideration of markets, plant location, raw material supply, processing methods, handling facilities, utilities, transportation and other factors.

The broad experience of the Corporation in the preparation of development and economic studies and reports in these specialized fields is available for new projects.





STONE & WEBSTER ENGINEERING CORPORATION

BADGER PROCESS DIVISION

AFFILIATED WITH E. B. BADGER & SONS LIMITED

The GOTHAM CONVERTIBLE

a recorder you never outgrow!

The most convertible, most interchangeable, most maintenance-saving instrument you've ever seen.

Deliberately designed so that the basic elements are identical for the 6", 9" and 12" chart size recorders. Temperature and pressure systems are also completely interchangeable. This flexibility enables you to convert instruments to suit your changing needs, at a minimum cost, minimum inventory, and without delay at the job site. Control through air relay or solenoid easily added. Full details in Catalogs 400 and 500.

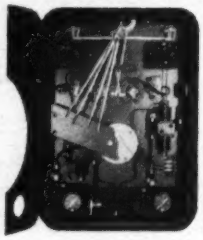
What you can do with the Gotham Convertible

Function	Chart Size 6"	9"	12"
1-Pen Recorder	X	X	X
Single Temperature or Pressure Controller, Indicating	X	X	X
2-Pen Recorder*		X	X
3-Pen Recorder*			X
4-Pen Recorder*			X
1-Pen Recorder-Controller		X	X
2-Pen Recorder-Controller*			X
1-Pen Recorder-Controller and 1-Pen Recorder *			X
1-Pen Recorder-Controller and 2-Pen Recorder *			X

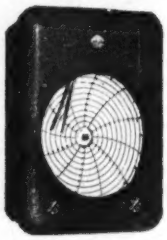
Functions above may be either Temperature or Pressure or Mixed (*)

IT'S A TEMPERATURE RECORDER

IT'S A PRESSURE RECORDER



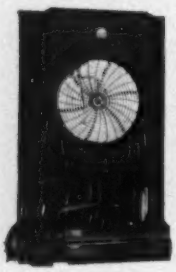
IT'S A TEMPERATURE OR PRESSURE RECORDER AND CONTROLLER



EXTERIOR OF THE GOTHAM CONVERTIBLE

AUTOMATIC TIMING CONTROLLER

Multiple cam type, designed to start and control a sequence of process operations. Opens or closes air valves or electric switches. Available in single cam type. Write for Catalog 500.



RECORDING PSYCHROMETER

Wet and dry bulb. Motor driven suction-type blower. Standard chart drive. Similar design available for Recording and Recording-Controlling Hygrometers. Write for Catalog 400.

PORTABLE RECORDERS—Handy, light-weight, mercury or vapor actuation, 6", 9", 12" chart sizes. See Catalog 400.

INDUSTRIAL THERMOMETERS

Straight or angle forms for all purposes. Temperature ranges between —40°F. and 950°F. Also Centigrade scales. Write for Catalog 100.

DIAL THERMOMETERS

Wide variety of case styles, temperature ranges, connections and fittings. Mercury, vapor, or gas-actuated. Rigid and adjustable stems. Write for Catalog 200.

PROGRAM CONTROLLER

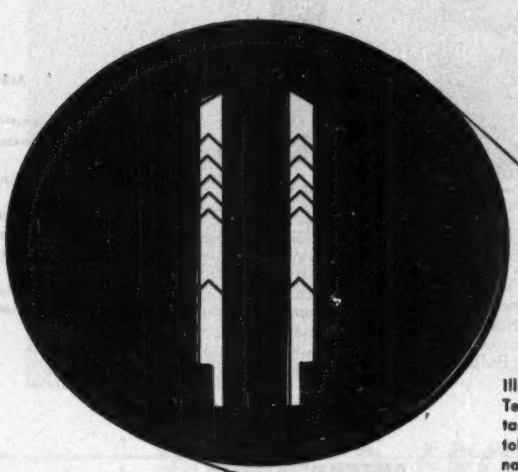
Controls either temperature or pressure vs. time. Controls and records time, rate of rise, hold value, and rate of cooling. All adjustments in this new instrument made from outside of case. Write for Catalog 500.

Keep Everything Under Control With Gotham

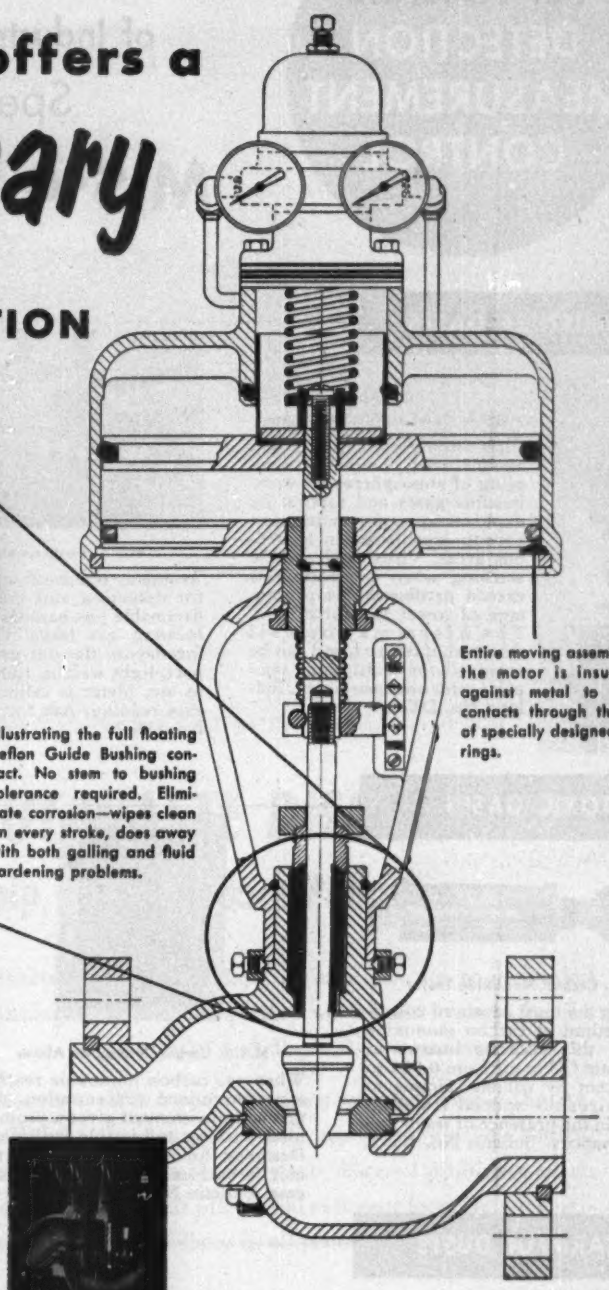
GOTHAM INSTRUMENTS

Division of AMERICAN MACHINE AND METALS, INC.
Sellersville, Pennsylvania

Now ANNIN offers a *Revolutionary* PRINCIPLE IN VALVE CONSTRUCTION



Illustrating the full floating Teflon Guide Bushing contact. No stem to bushing tolerance required. Eliminate corrosion—wipes clean on every stroke, does away with both galling and fluid hardening problems.



Entire moving assembly of the motor is insulated against metal to metal contacts through the use of specially designed "O" rings.

By incorporating a Teflon Guide Bushing,—Annin design provides mechanical perfection in control valve operation. How? Because now Annin valve offers full floating operation free from any metal to metal contact in moving parts. The valve stem floats in contact with Teflon,—the Domotor portion of the valve floats on Hycar "O" rings. Teflon eliminates valve stem galling, and all difficulties which develop when soft, corrosion resisting alloys are in contact as bearings.

Teflon is self-lubricating and requires no external lubrication. It won't stick so the customary tolerance between guide bushing and valve stem is eliminated. With the new type guide bushing used by Annin, an interference fit is provided and solidly retains the valve stem and plug assembly. The stem is wiped clean on every stroke preventing scale or dirt from scoring or any tendency toward fluid hardening problems. Valves now in service may be changed over to the new guide material.

Write for your copy now

CUT INVENTORY 50% WITH

ANNIN *Control* VALVES

THE ANNIN COMPANY 3500 Union Pacific Avenue
Los Angeles 23, California

DETECTION
MEASUREMENT
CONTROL

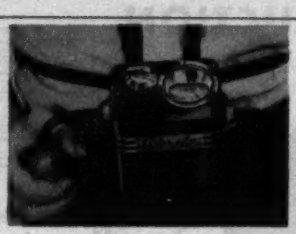
of Industrial Atmospheric Hazards
Specify Dependable

M·S·A INSTRUMENTS

COMBUSTIBLE GASES

M.S.A. Combustible Gas Alarm

This widely-used instrument assures safe, continuous sampling of atmospheres for combustible gases and vapors. Its explosion-proof construction permits installation in hazardous areas. Visual and audible warning when concentrations exceed predetermined percentage of lower explosive limit. The Alarm may be wall mounted, if desired, and can be arranged for multi-point sampling with one instrument. Bulletin No. DT-6.



M.S.A. Explosimeter

Accurate, one-hand operation for detecting and measuring flammable gas hazards and for locating gas leaks. Designed for day-in, day-out use. Compact, light weight, sturdy, easy to use. Meter is calibrated for easy reading. Ask for Bulletin No. DN-7.

M.S.A. Lira

This infra-red gas and liquid analyzer is ideal for measuring atmosphere contamination and for process control. It is extremely accurate, with rapid response to changing concentrations. Designed for permanent installation and continuous recording. Bulletin No. DZ-4.

ALSO:

- Combustible Gas Indicators
- Benzol Indicators
- Methane Alarms, Detectors, Recorders
- Oxygen Indicators and Recorders

TOXIC GASES

M.S.A. Carbon Monoxide Tester

Employing the most advanced colorimetric method of carbon monoxide detection, this accurate instrument will indicate CO in air from 0.001 to 0.10 percent by volume. Simple to use; requires no special training. Accurate in the presence of water and gasoline vapors. Bulletin No. BY-1.

M.S.A. Carbon Monoxide Alarm

Whenever carbon monoxide reaches a predetermined concentration, this precision instrument gives a prompt, loud warning and visible indication. Designed for 24 hour service, the unit is enclosed in a weather-proof case. Bulletin No. DR-2.

M.S.A. Hydrogen Sulfide Detector

Quick detection and accurate measurement of low but dangerous concentrations of hydrogen sulfide in air and process gases. Detects amounts ranging from 0.0025 to 0.04 percent by volume. Supersensitive models available for 0 to 50 p.p.m. Bulletin No. DY-3.

ALSO:

- Carbon Monoxide Detectors, Indicators, Recorders
- Mercury-Vapor Detectors
- Hydrocyanic Acid Gas Detector
- Aromatic Hydrocarbon Detector
- Nitrogen Dioxide Detector
- Samplair (for toxic dust or mist determination)

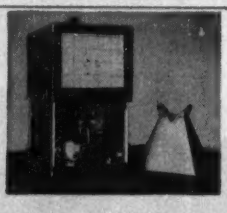
HARMFUL DUSTS

M.S.A. Midget Impinger

A compact, easy to operate intrument for obtaining accurate samples of particulate matter. Samples at the rate of 1/10 cubic feet per minute. Portable, self-contained, this unit is ideal for dust control and survey work. Bulletin No. CT-6.

M.S.A. Electrostatic Sampler

High efficiency in atmospheric sampling for all types of particulates including dust and fumes from molten metal and smoke. Features a portable head for sampling at various levels. Convenient to carry. Bulletin No. CT-9.



M.S.A. Dust-Vue Microprojector

Permits rapid, easy counting of dust particles in collected samples, and particle size determination. Magnifies to 1000 times in size on ruled translucent screen—relieves eye-strain and permits greater accuracy. Bulletin No. CT-7.

ALSO

- Dust Counting Microscope
- Cascade Impactor
- Dust Counting Cells

MINE SAFETY APPLIANCES COMPANY

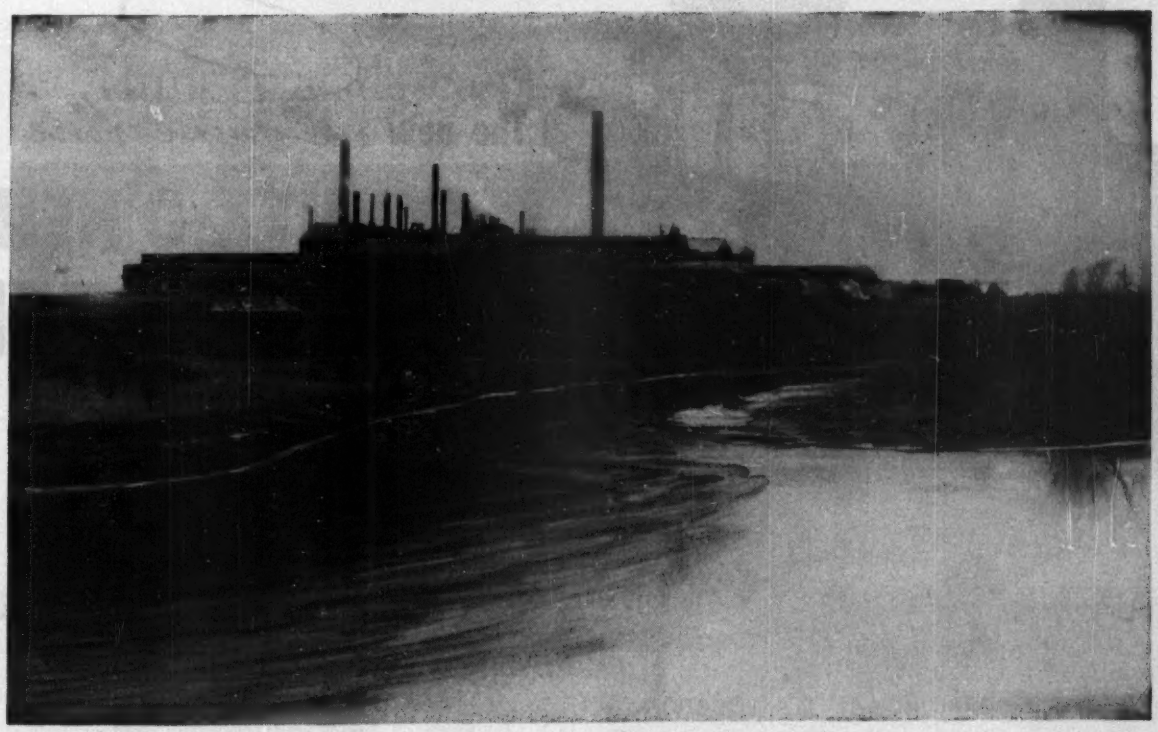
Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.

At Your Service: 48 BRANCH OFFICES in the UNITED STATES

MINE SAFETY APPLIANCES CO. OF CANADA LIMITED
Toronto, Montreal, Calgary, Winnipeg, Vancouver, New Glasgow N. S.

Representatives in Principal Cities in Mexico, Central and South America
CABLE ADDRESS: "MINSAF" PITTSBURGH

MSA
SAFETY EQUIPMENT HEADQUARTERS



WORRIED ABOUT WASTE DISPOSAL?

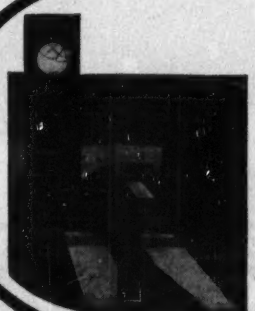
Bailey Meters Help you to Reduce Pollution

● The disposal of industrial wastes without stream pollution calls for careful planning and continuous vigilance.

That's where Bailey Meters and Controls come in. We measure the flow and pH of sewage, sludge, and industrial wastes flowing in open channels or pipe lines. These and other factors, such as levels, rates of chemical feed, and flow of air, may be co-ordinated into a completely automatic system for the treatment and disposal of waste materials.

When you want fast, complete and authoritative answers to the measurement and control aspects of your waste disposal problems, reach for your phone and call your local Bailey Engineer. Offices in all principal industrial centers.

P-24



BAILEY
OPEN CHANNEL METERS

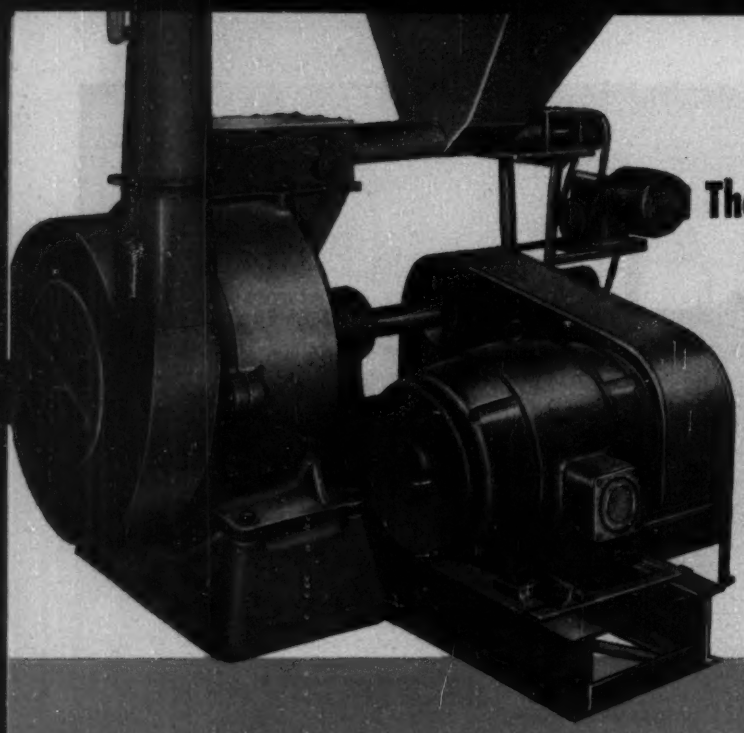
These indicating, recording and integrating meters are suitable for measuring industrial wastes, sewage, sludge, corrosive liquids, and irrigation water flowing in all types of open channel primary metering devices, such as Venturi flumes, weirs, or nozzle flumes. Electric or pneumatic telemetering permits location of receivers wherever desired. Ratio of flows and chemical feeds may be controlled automatically.

BAILEY METERS

BAILEY METER COMPANY

1054 IVANHOE ROAD
CLEVELAND 10, OHIO

Process Controls TEMPERATURE · FLOW · PRESSURE · LEVEL · GAS ANALYSIS · RATIO



The new *Superfine*

SCHUTZ-O'NEILL PULVERIZER

backed by

60 YEARS

of experience

AIR FORCE PULVERIZING—AIR CLASSIFICATION

Here is a proven, automatic and dustless method of pulverizing any grindable material to your desired fineness. For extremely fine grinding and uniform particle size distribution of product, the principle of centrifugal impact with air attrition utilized so efficiently by the Schutz-O'Neill "Superfine" Pulverizer has never been surpassed. The centrifugal force recirculates coarse particles within the mill for regrinding. The air classification carries the fine particles out of mill as uniform product of the desired particle size.

ADAPTABLE TO THE COMPLETE RANGE OF PULVERIZING FROM COARSE TO ULTRA FINE

The ease of grinding and the versatility of the unit are two features not found in any other pulverizer on the market. With proper adjustments, this mill will produce particles from 40 mesh to low micron sizes under conditions that enable you to accurately control not only particle size but also the size distribution in the product. This can be done while maintaining grinding temperatures below 125-130°F. The mill is ordinarily set for fine powdering duty, but if a coarser product is desired, it can be readily obtained by proper adjustment in the grinding and classifying chambers.

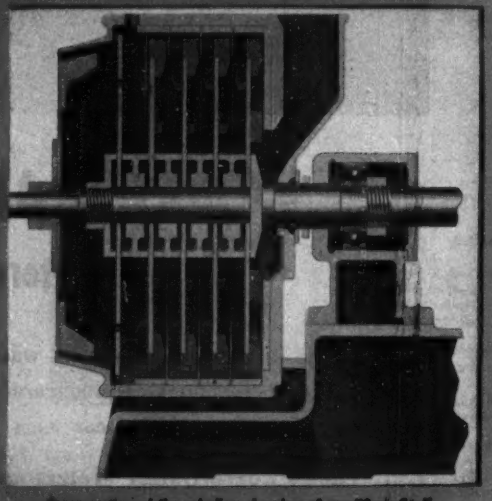
COMES APART IN 10 MINUTES, EASY TO CLEAN, ADJUST, REPAIR

Ten minutes is all you need to take apart a Schutz-O'Neill "Superfine" for cleaning, to adjust for fineness, or replace any part. Remove 2 pins and cone housing lifts off. Loosen 1 set screw and 1 nut and all other parts slide right off the center shaft. It is unmatched for accessibility and simple, rugged design.

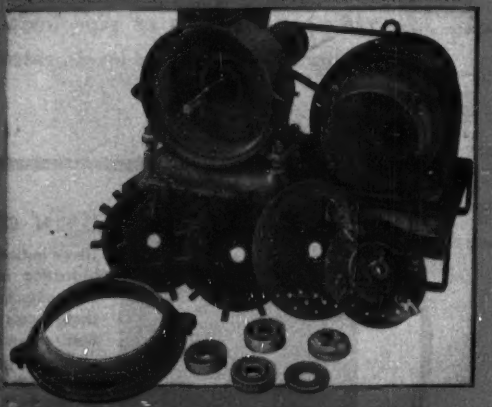
LET SCHUTZ-O'NEILL GRIND A TEST SAMPLE FOR YOU

Send us a 50 lb. stock sample stating what your material is and fineness desired. You will receive your pulverized stock plus our engineering report giving complete details of process used together with recommended equipment, methods and mill plans.

WRITE US FOR THE NAME OF SCHUTZ-O'NEILL SALES ENGINEER NEAREST YOU.



Cross section of the grinding chamber of our "Superfine" Pulverizer showing from left to right the cone plate, perforated mill plate and 4 beater plates with multi-section liner divided by annular rings.



Here is a disassembled mill. Every part separated and accessible—corrugated liners exposed for easy cleaning, exchange or replacement.

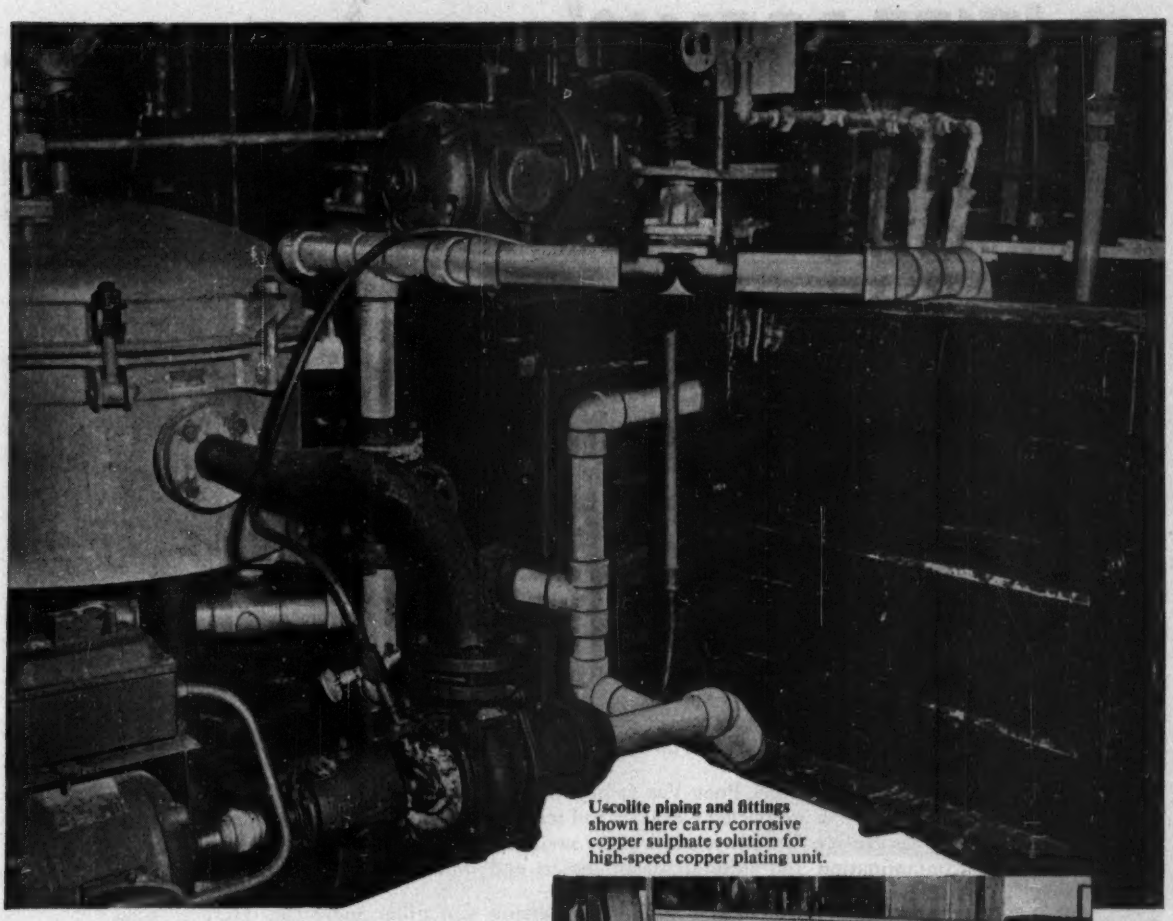
ESTABLISHED 1893

SCHUTZ-O'NEILL COMPANY

PULVERIZERS · GRANULATORS · ROLLER MILLS · AIR CLASSIFIERS · SIFTERS · HAMMER MILLS

301 PORTLAND AVENUE • MINNEAPOLIS 15, MINN.

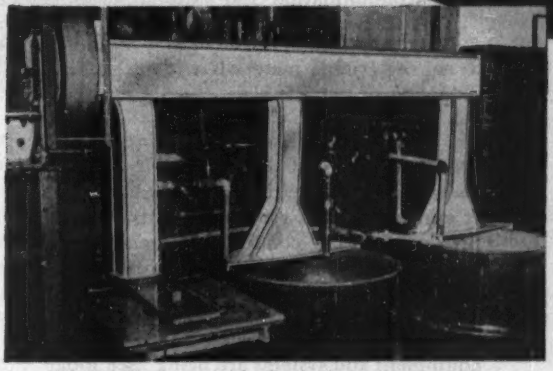
Hungry acids can't eat U. S. Uscolite® pipe



Uscolite piping and fittings shown here carry corrosive copper sulphate solution for high-speed copper plating unit.

A LARGE phonograph record factory needed a piping system which would stand up under the corrosive effects of acids. United States Rubber Company engineers were called in for consultation. They recommended piping, ducts and fittings made of Uscolite, the great "U.S." plastic . . . and the acids gave no more trouble.

Uscolite is resistant to *most* chemicals, acids and alkalies. It has amazingly high impact strength, is easy to handle, can be cut to length and threaded on the job. If you have any difficulties with piping, you can't afford to overlook Uscolite. Call any of our 25 District Sales offices (each is staffed with engineers) or write to address below.



This Uscolite duct, used in the de-chrome room, carries away fumes from a 50% hydrochloric solution at 160 degrees F. The factory also uses U.S. Steam Hose and U.S. Transmission Belts.

U.S. RUBBER
SERVING THROUGH SCIENCE

"U.S." Research perfects it
"U.S." Production builds it
U.S. Industry depends on it

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

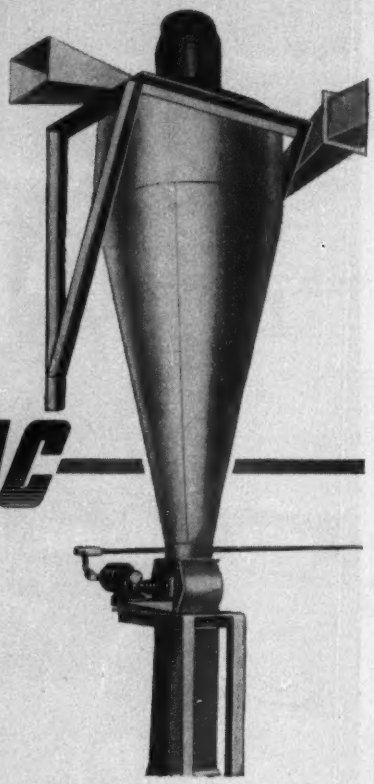
Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Grinding Wheels • Packings • Tapes • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

We make "PIPE DREAMS" come true

SPROUT-WALDRON
equipment and systems for

HANDLING • MOVING • LOADING
UNLOADING BULK MATERIALS

PNEU-VAC



Sprout-Waldron's Pneu-Vac will probably bring reality to your plant engineer's dream of truly efficient materials handling . . . because with Pneu-Vac you can convey powdered, granular and flaky materials *anywhere you can run a pipe!*

In many modern plants, Pneu-Vac (a negative pressure system) is rapidly replacing bucket elevators and screw conveyors, because it has greater flexibility, offers many savings, and eliminates contamination and infestations of insects and rodents.

One of its many advantages is its ability to convey friable materials with negligible reduction of particle size.

Specially engineered for individual processing needs, Pneu-Vac is self-cleaning and can be designed to aerate, cool and dry. It eliminates dust, reduces hazards and improves working conditions. Pneu-Vac is swift, sanitary, safe and saves time, labor, space and money!

Sprout-Waldron materials handling equipment and systems are being used today in thousands of conveying jobs in the processing and other industries. Here is what Sprout-Waldron can offer you . . .

1. *Pneu-Vac, spiral, belt and bucket conveying systems for a wide range of applications.*
2. *A broad background in solving many types of conveying problems.*
3. *Complete facilities for engineering, pilot testing and fabrication.*

Write to: Sprout-Waldron & Co., Inc., 15 Logan Street, Muncy, Pennsylvania.

SPROUT-WALDRON
Manufacturing Engineers
MUNCY • PENNSYLVANIA

318

MODERN EQUIPMENT FOR: Size Reduction • Mixing and Blending • Bulk Materials Handling • Product Classification • Pelleting & Cubing

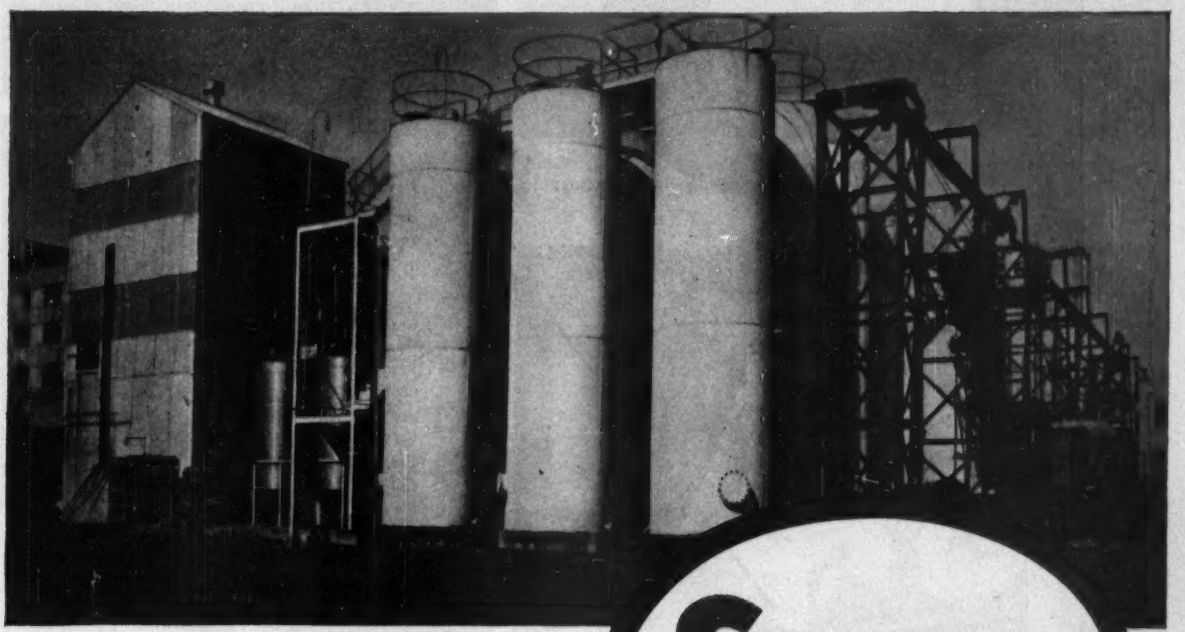
New and Improved

Money Saving—Product Improving

OXO ALCOHOLS

ISO-OCTYL **DECYL** **TRIDECYL**

(BRANCHED PRIMARY ALCOHOLS)
for the Chemical Industry



ENJAY

A pioneer and leading marketer of Oxo Alcohols, the Enjay Company and its affiliates with greatly expanded plant facilities are producing a new line of branched primary alcohols. More and more manufacturers of esters, plasticizers, synthetic oils, detergents and other chemical derivatives are turning to Enjay for money-saving, product-improving Oxo Alcohols.

A complete line of dependable products for industry

PETROLEUM	SURFACE COATING	CHEMICAL
PARANOX	PETROHOL 91	PETROHOL 91
PARATONE	PETROHOL 95	PETROHOL 95
PARAFLOW	PETROHOL 99	PETROHOL 99
PARAPOID	Secondary Butyl Alcohol	Iso-Octyl Alcohol
PARADYNE	Secondary Butyl Acetate	Decyl Alcohol
PARATAC	Isopropyl Acetate	Tridecyl Alcohol
PETROHOL	Acetone	Benzene
Methyl Ethyl Ketone	Methyl Ethyl Ketone	Dicyclopentadiene
Dewaxing Aid	Ethyl Ether	Isoprene
Ethyl Ether	Isopropyl Ether	Butadiene
Isopropyl Ether	Dicyclopentadiene	Ethyl Ether
Reference Fuels	Naphthenic Acids	Isopropyl Ether
	Iso-Octyl Alcohol	Tripropylene
	Decyl Alcohol	Tetrapropylene
		Aromatic Tars
		Acetone
		Methyl Ethyl Ketone

The Enjay Company has long been recognized as a leader in the development and marketing of high-quality products for the oil, surface coating and chemical industries. Backed by greatly expanded plant and distribution facilities, the Enjay Company is supplying a constantly growing list of chemical products to many different industries.

BE SURE TO CALL ON ENJAY FOR YOUR CHEMICAL NEEDS

ENJAY COMPANY, INC.

15 West 51st Street, New York 19, N. Y.

Fill your chemical processing

with Norton SPECIAL Refractories engineered to your needs

To improve chemical processes or increase yields, get your answer from Norton.

No *one* refractory can be the solution to all your problems. But Norton Rx service will help you get the composition best suited to your particular purpose.

In almost every field of chemical processing, Norton Refractories are making definite contributions — improving methods and cutting costs. This is true in catalyst supports for the manufacture of phthalic anhydride, for reforming natural gas and production of "atmosphere gas" — electric furnace shapes . . . porous mediums, for filtration, diffusion and aeration.

To get your Rx in catalyst supports

Norton makes catalyst supports having *controlled* structure. Thus the Rx for rings and pellets can range from medium porosity to high porosity — for spheres from medium porosity with rough exterior for coating with a catalyst, to high porosity with a network of open pores throughout and rough exterior designed for impregnating with catalyst. Spheres are made in diameters ¼″ to 1″. Rings supplied from 3/32″ I.D., 3/16″ long, 7/32″ O.D. to ½″ I.D., 1″ long, 1″ O.D. Pellets from ⅛″ x ⅛″ to ½″ x ½″. Catalyst supports are just an example of Rx engineering.

The "Basic 4" for your Rx

According to the requirement your Rx is for ALUNDUM*, CRYSTOLON*, MAGNORITE*, or FUSED STABILIZED ZIRCONIA, each with its own particular characteristics. All are chemically stable . . . all are highly refractory, resistant to abrasion and have extra long life. Here are just a few of their uses in many fields.

***Norton ALUNDUM* catalyst supports in the manufacture of phthalic anhydride, production of "atmosphere gas" and in reforming natural gas.**

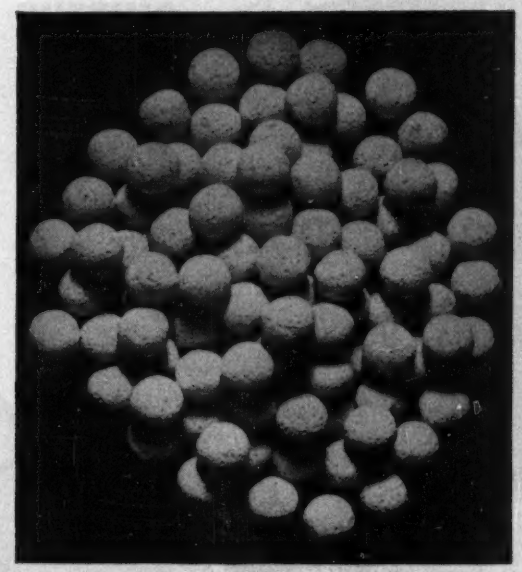
***Norton FUSED STABILIZED ZIRCONIA* has stood up under 4700°F in gas synthesis. Its low thermal conductivity and its high electrical conductivity at elevated temperatures make it useful for many special chemical processes. No other refractory is so chemically stable under high temperature.**

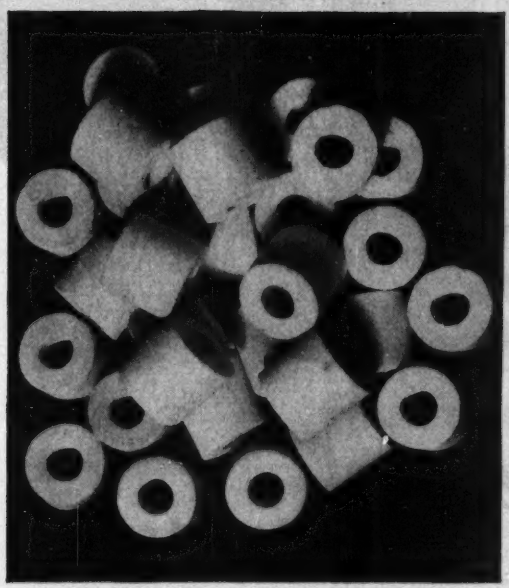
***Norton ALUNDUM* porous mediums with "controlled permeability" are ideal for filtration, diffusion or aeration.**

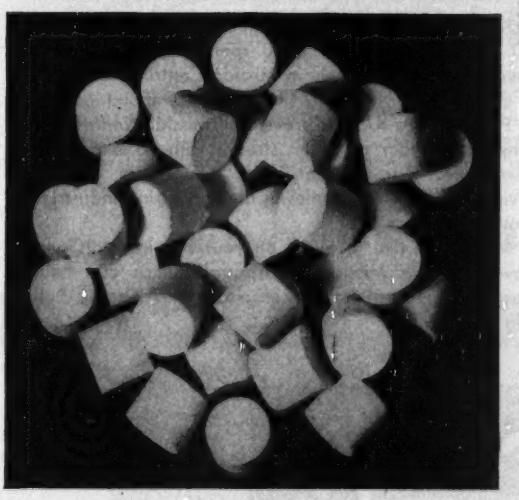
***Norton ALUNDUM, CRYSTOLON and MAGNORITE* mixtures for reaction furnaces are supplied in a variety of shapes engineered to your exact requirements.**

Find out more

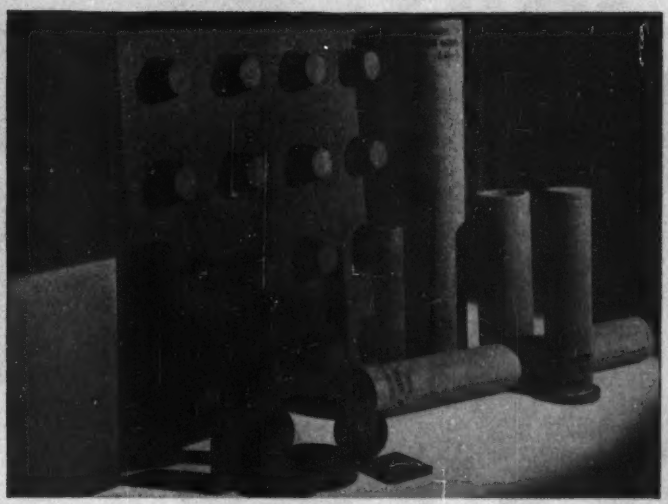
So broad is Norton's range of Special Refractories that it can only be outlined here. We believe that it will pay you to make Norton Refractory Research your partner in solving your problems. For quick action, just contact your Norton Refractories Representative or write NORTON COMPANY, 507 New Bond St., Worcester 6, Mass.



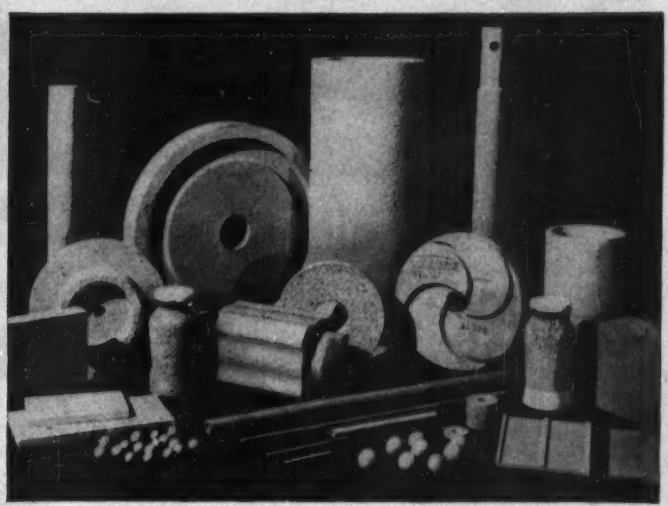




Norton catalyst supports are made in spheres, pellets and rings, by Norton's "controlled structure" process.



Norton ALUNDUM porous mediums come in plates, tubes, discs and diaphragms to fit your exact requirements.

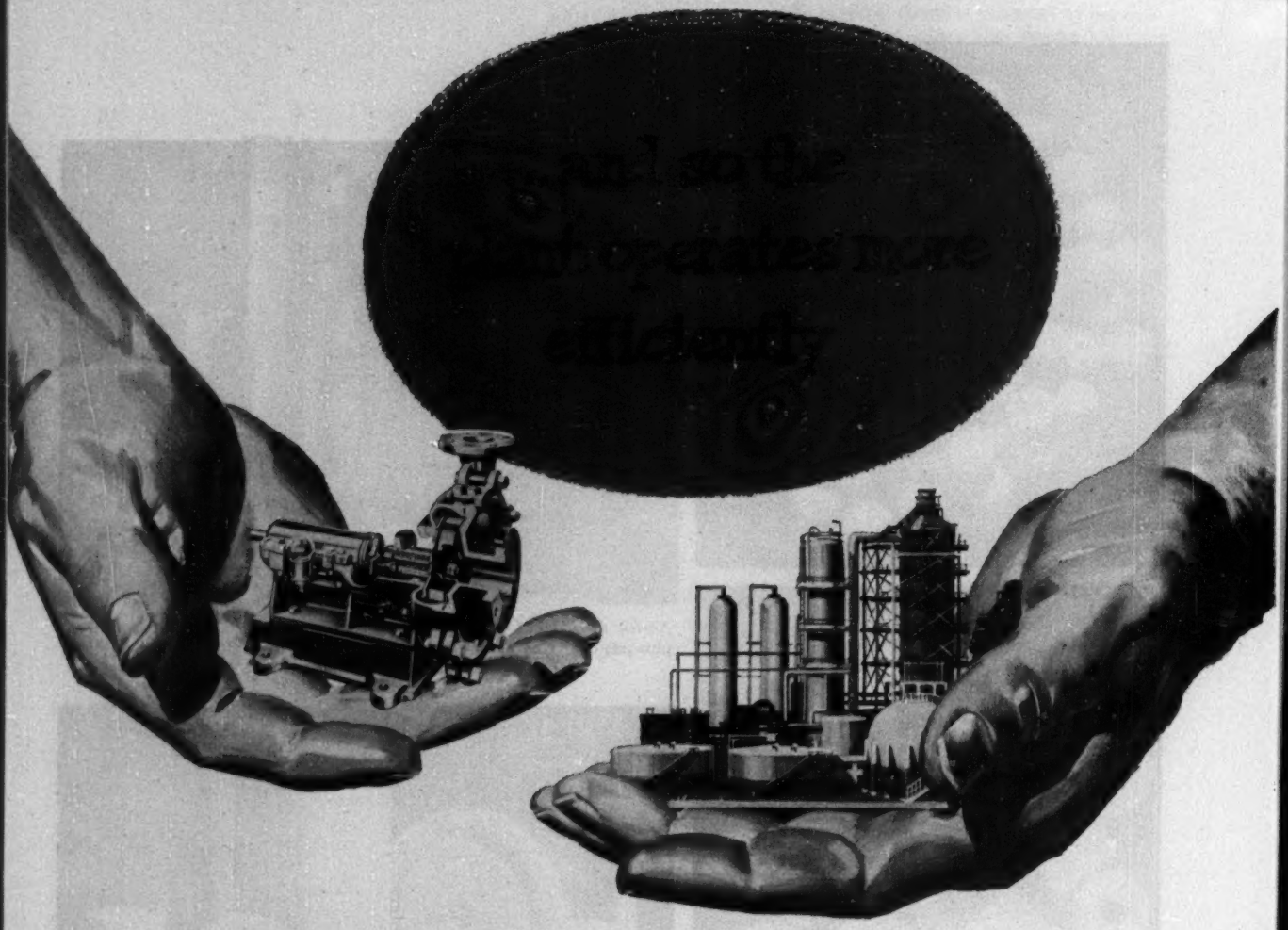


Norton refractory shapes for reaction furnaces come in bricks, plates, tubes and blocks of ALUNDUM, CRYSTOLON, MAGNORITE and FUSED STABILIZED ZIRCONIA.

Special REFRACTORIES

Making better products to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



because

MISSION *Centrifugal* Pumps Last Longer

The concentric casing design of Mission Centrifugal Pumps minimizes the excessive turbulence and cavitation normally caused by cut water in the conventional design which causes wear. The reduced turbulence affords smoother operation of the pump making the over-size heavy-duty bearing last longer under severe conditions and the rugged construction of Mission pedestal parts also affords longer life.

The special bearing housing can be replaced completely without disturbing pedestal alignment or casing, impeller clearance adjustment by external screw, high interchangeability of parts reduces replacement inventory, casing sizes ranging from 1" to 6" discharge, capacities up to 1800 gpm, heads up to 350 feet, speeds up to 3500 rpm. These and many other features found only in Mission Centrifugal Pumps all combine to give long life and easy maintenance.

Performance records prove that Mission Centrifugal Pumps keep your plant on stream with no expensive down time. Mission Centrifugal Pumps are now in service for major companies in the processing industries throughout the world.

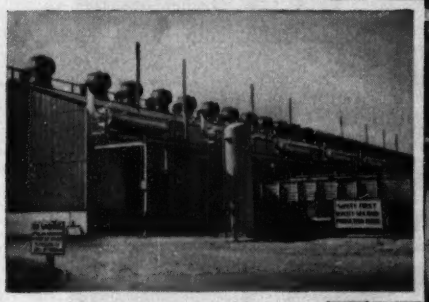
We would like to quote on your requirements and show you how Mission Centrifugal Pumps can help your plant operate more efficiently. Write for Bulletin CP-452.

MISSION

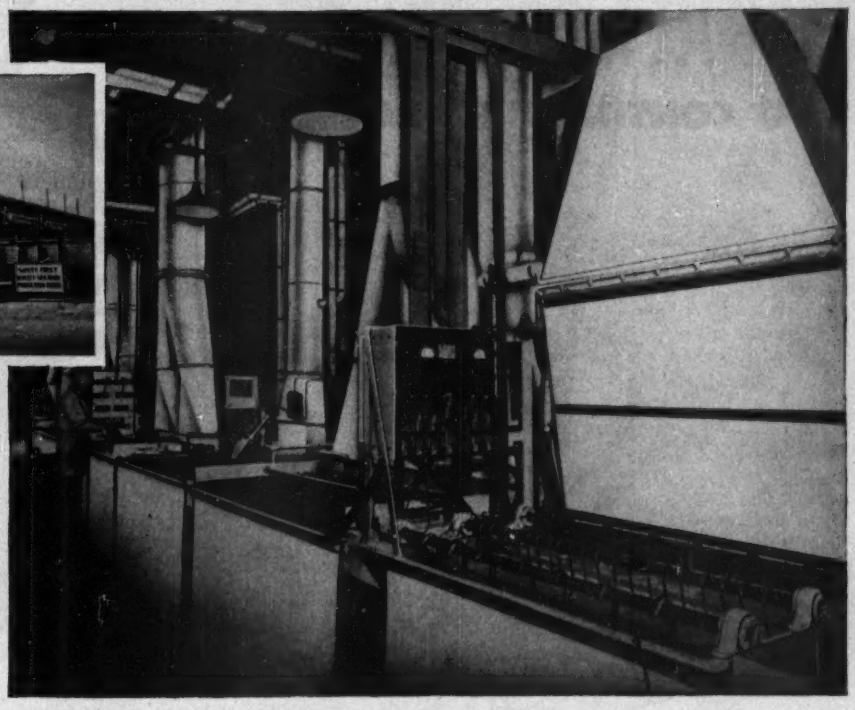
Humble Road, P. O. Box 4209, Phone MUlberry 5561 Export Office: 30 Rockefeller Plaza, New York
Handled by representatives in all industrial areas . . . and by supply stores in every oil country.

PUTTING *Air* TO WORK FOR

FUME CONTROL



General exhaust of an entire building where fumes are generated.



Exhaust system consisting of hoods, piping and fans, for collection of fumes and vapor at point of generation.

Improves Working Conditions
Eliminates Fire Hazards
Lowers Maintenance Costs

Proper fume control can eliminate fire or explosion hazards, improve employee health and morale through better working conditions, and lower maintenance costs. To help solve *your* fume control problem, Sturtevant has a wide background knowledge based on a variety of applications in many industries.

The systems pictured are equipped with Sturtevant fans (1) to collect and exhaust explosive fumes that result from processing operations dispersed throughout a general area, or (2) to carry off injurious vapors where individual operations generate corrosive or injurious smoke and fumes within a confined area. Whatever the application, Sturtevant can provide fans, exhausters and air handling apparatus to handle fume problems in your plant.

To obtain complete information on your problem, contact your local Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

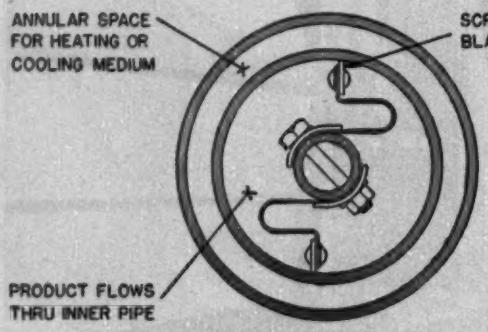
YOU CAN BE SURE...IF IT'S **Westinghouse**

PUTTING *Air* TO WORK

J-80201B

Time to Change...

...FROM BATCH TO CONTINUOUS PROCESS



Section thru Double Pipe Exchanger

Scraped Surface Exchanger Unit under test in our shop

Unsurpassed for Top Performance in Processing characterized by:

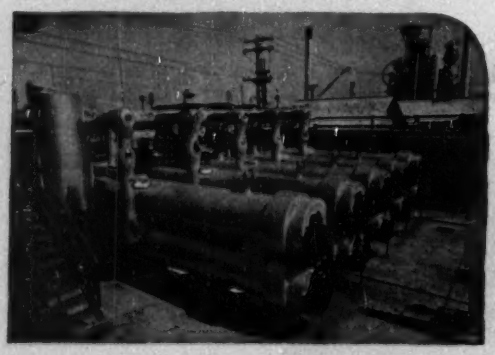
1. Heat transfer with crystallization
2. Heat transfer with severe fouling of surfaces
3. Heat transfer with solvent extraction
4. Heat transfer with continuous mixing and conveying
5. Heat transfer with high viscosity

Chemical processors in search of equipment with which to modernize operations are invited to consider the possibilities of Vogt *flow-thru* Scraped Surface Exchangers in such service. The wide range of uses to which they have been adapted indicates their definite value in the chemical processing fields.

Vogt Scraped Surface Exchangers are closed, *flow-thru,* pressure type systems which permit the use of flammable, volatile and expensive solvents with greatest safety and no danger of solvent loss. Usually fabricated from ferrous material, their simple construction permits the ready use of special materials such as pure nickel or stainless steel to meet special requirements.

General information is in Bulletin PE-1, write for it.

An outdoor installation of Scraped Surface Exchangers



Vogt flow-thru

Scraped Surface EXCHANGERS

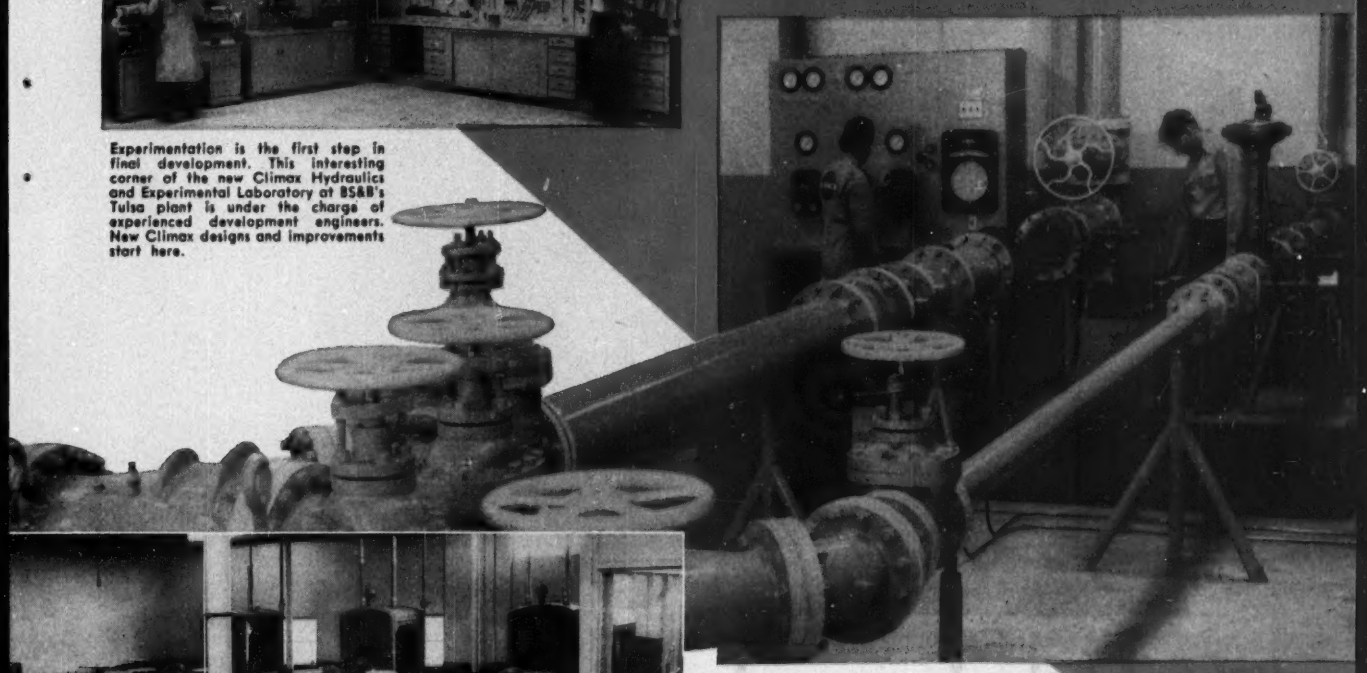
HENRY VOGT MACHINE CO.
LOUISVILLE, KY.

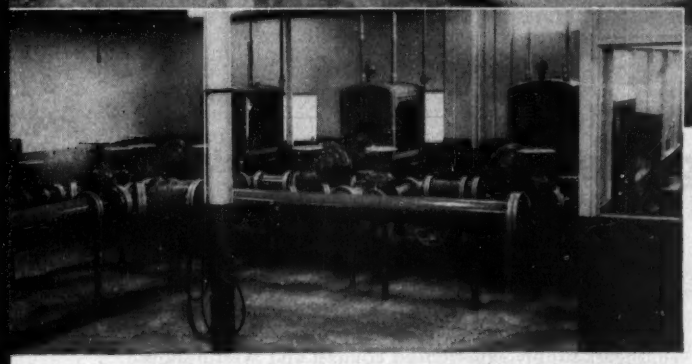
BRANCH OFFICES:
New York, Philadelphia, Chicago, Cleveland
St. Louis, Dallas, Charleston, W. Va.

Testing the performance on which BS&B reputation has been built:

Pre-Proving CLIMAX CONTROLS to Insure On-The-Job Efficiency

Experimentation is the first step in final development. This interesting corner of the new Climax Hydraulics and Experimental Laboratory at BS&B's Tulsa plant is under the charge of experienced development engineers. New Climax designs and improvements start here.





The finished control on the "torture rack." Meter runs flow test the valves up through 10". Strain gauge equipment analyzes forces and stress under performance. Control panel in background regulates engines driving the pumps and registers flow data for calculation.

Pump manifolding for the 3 engine-driven pumps which will deliver up to 4500 gallons per minute at a 100 lb. discharge for high volume tests. Pumps can also be manifolded for series operation, in which case 300 lbs. of water at 1500 gallons per minute can be delivered.

There's no question about a Climax Control giving the satisfactory service for which it is designed. That performance is tested and proven before the control goes into the field . . . checked for minimum and maximum capacity. Flow, flow effects, valve characteristics and strain results are all evaluated by experienced engineers. Through the new BS&B Climax Control Hydraulics laboratory come a continuing series of answers to the more efficient, safe and profitable application of automatic controls. One test suggests another, one application is adapted to a similar problem. The net result: Through research, better engineering, and accurate pre-testing, comes a more efficient Climax Control.

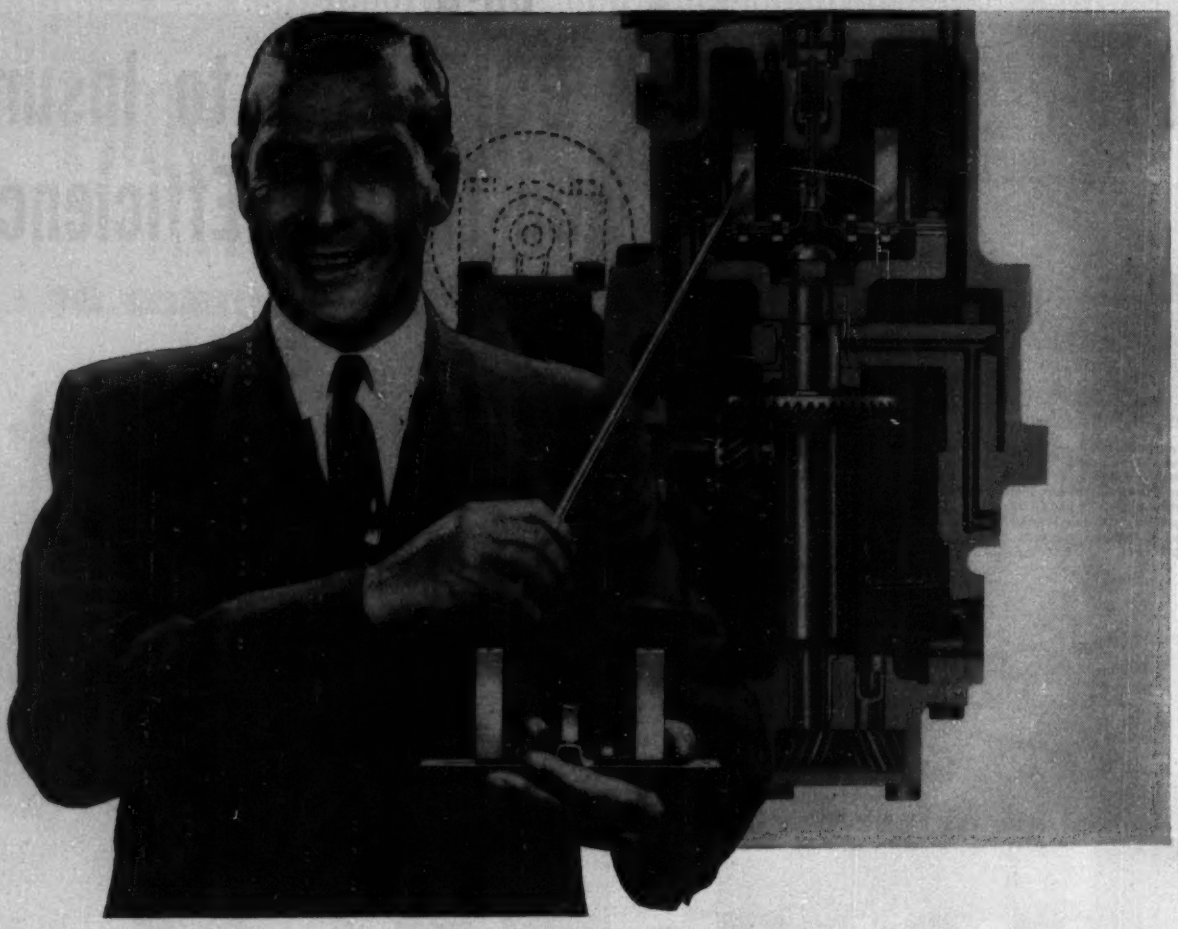
New Climax Controls Hydraulic and Experimental Laboratory

See our exhibit at the Eighth National Instrument Exhibit, September 21 to 25, Sherman Hotel, Chicago Booths 148 to 150.

BLACK, SIVALLS & BRYSON, INC.

Climax Controls Division, Dept. 4-N8
7500 East 12th Street • Kansas City 26, Missouri

CLIMAX BS&B CONTROLS OUR 60TH YEAR



"This frictionless sensing element prolongs turbine speed control accuracy"

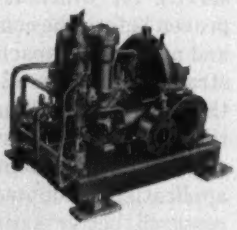
It is a no-travel, frictionless device. It operates in a system which balances forces of oil pressure against centrifugal force. Speed changes reflected in centrifugal force variations are hydraulically transmitted to other elements in the governing system without bearings, knife edges or marked mechanical travel. Simple and maintenance-free, it has no parts to wear, replace or adjust . . . retains precision under the most demanding operating conditions.

Development of this exclusive sensing element to make the Vertical Oil-Relay Governor a precise, trouble-free speed regulator typifies Westinghouse thoroughness in building exceptional reliability into all components of the Type E Turbine line. Over 50 years of expanding engineering and productive facilities, on turbines from 1 hp to the largest made, have achieved manufacturing skills which assure extra-dependability in every Westinghouse prime mover.

Matching the superior design and construction of these turbines is a fully qualified field organization. Application engineers supply experienced counsel and Westinghouse service shops and parts stocks are located coast to coast. Contact your nearest Westinghouse Sales Representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50552

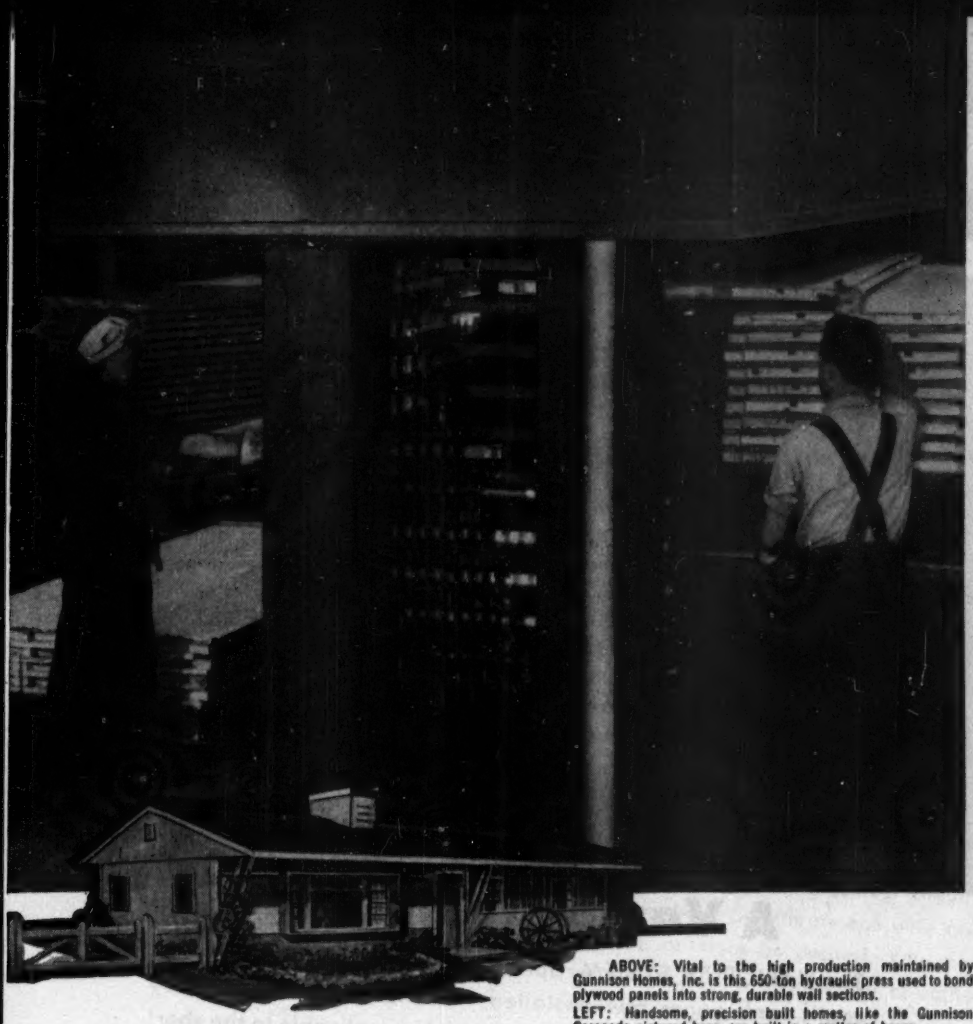
The Type E-125
General-Purpose Turbine

A packaged unit incorporating the Vertical Oil-Relay Governor, and rated 5 to 1500 hp. It can handle all types of loads requiring high-quality speed control.



YOU CAN BE SURE...IF IT'S Westinghouse

Turbines for every industrial use



ABOVE: Vital to the high production maintained by Gunnison Homes, Inc. is this 650-ton hydraulic press used to bond plywood panels into strong, durable wall sections.
LEFT: Handsome, precision built homes, like the Gunnison Coronado pictured here, are built in a matter of hours.

Answers a pressing need for Gunnison Homes, Inc. . . .

● Gunnison Homes, Inc., situated in New Albany, Indiana, is one of the leaders in the field of manufactured homes. Key to continuous production of precision built homes at the New Albany plant is the 650-ton hydraulic press, shown above, which was installed in 1947. This press processes ten plywood panels every cycle by the combination of heat and pressure . . . a tough job and one requiring reliable hydraulic performance to maintain production schedules.

STANOIL Industrial Oil was installed in the press when it was put into operation six years ago. STANOIL has stood the test of severe operation . . . with no evidence of oil deterioration being found during a recent inspection of the hydraulic system. Operation has been efficient. Minimum make-up oil has been needed to maintain the oil capacity of 450 gallons.

STANOIL
TRADE MARK
Industrial Oil

Find how STANOIL can benefit you by discussing this multi-purpose oil with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

What's YOUR problem?

Ralph E. Murnahan, of Standard Oil's Evansville office, is the lubrication specialist who keeps in constant contact with Gunnison Homes to make certain that there is no interruption of operation due to lubrication difficulties.

He is one of many lubrication specialists who make their headquarters in Standard's offices throughout the Midwest. These men have been specially trained in Standard's Lubrication Engineering Schools and, in addition, have a wealth of on-the-job experience.

To obtain the service of the lubrication specialist in your area, you need only call your local Standard Oil office. The lubrication specialist will discuss your lubrication problems with you . . . at no obligation to you, of course. He has a complete line of petroleum products to offer you, including:

SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

STANOLITH Greases—Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

STANDARD OIL COMPANY **STANDARD** *(Indiana)*

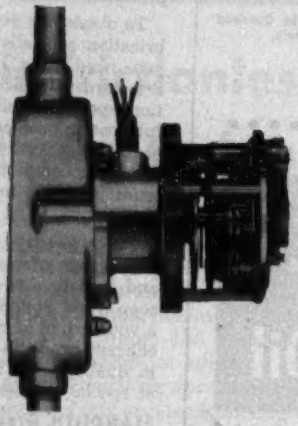
New— Telegraphic

UTILIZES EXISTENT

The Greatest Advance in Remote Gaging!

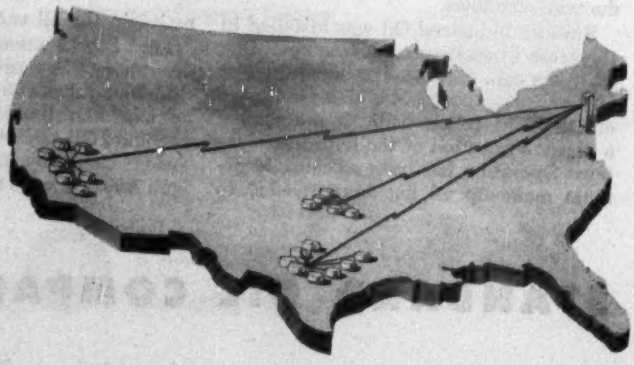
The VARIOPLEX SYSTEM of remote level gaging represents an even greater advance over automatic gaging than the automatic tank gage over manual measurement. Here, at last, we have real PUSH BUTTON gaging, minus the prohibitive cost of building and maintaining expensive transmission lines, which has limited the distances over which other remote gages could be considered practical.

A Versatile System



The VARIOPLEX SYSTEM, operating in conjunction with automatic tank gages now installed, transmits measurements by electrical impulses—8 per second—and is applicable to the short distances of tank farm to control room, using the company's own transmission lines, or CROSS COUNTRY gaging over leased wires. The same impulses can be transmitted by microwave or by radio—if these media are presently available. Although born to the petroleum industry, it is equally applicable to the gaging of liquid levels in the chemical industry, paint and varnish, vegetable oils, food processing, distilling, etc. It will also be of interest to public utilities and government agencies concerned with measuring the rise and fall of water levels in lakes, reservoirs, rivers, canals and dams.

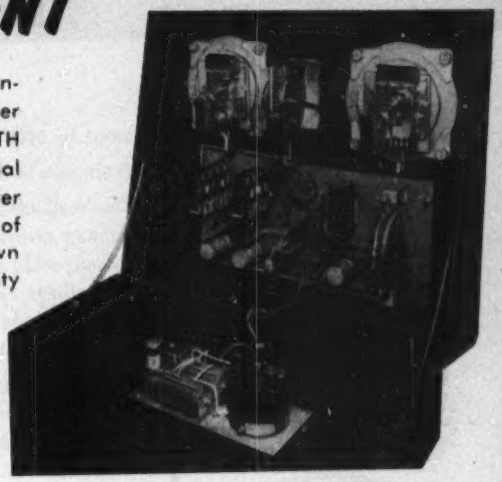
It seems almost too good to be true, but today an operator in the control room in a New York Skyscraper can gage any number of tanks located in far away Texas or California in a matter of seconds—in fact it takes just 25 seconds for each tank being gaged to identify itself and rack up the number of feet, inches and eighths of an inch. An adept gager can record the measurements of two tanks per minute after the initial circuit is closed.



Determination of Liquid Levels

COMMUNICATIONS EQUIPMENT

The VARIOPLEX SYSTEM incorporates some of the best proven principles of the dial telephone and the telegraph and is equal to either or both in accuracy. The system was designed for installation WITH other communications equipment operated by almost every industrial concern doing a national or international business. It is not a matter of "throwing out the old and installing the new"—it is a matter of utilizing existent communication systems to their utmost. Your own Communications Engineer can best advise you as to the applicability or compatibility of VARIOPLEX to your present system.



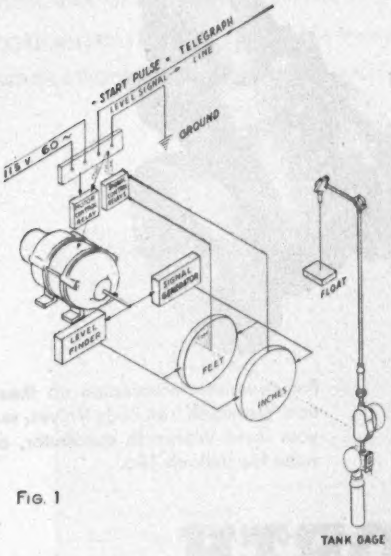
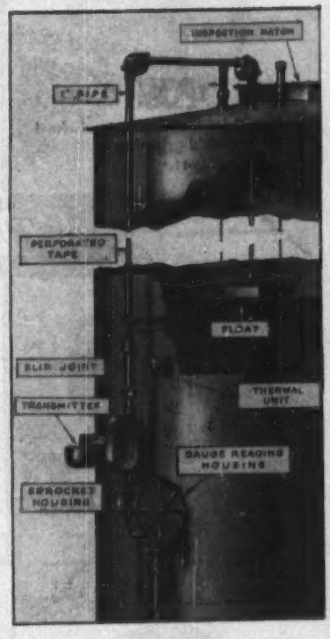


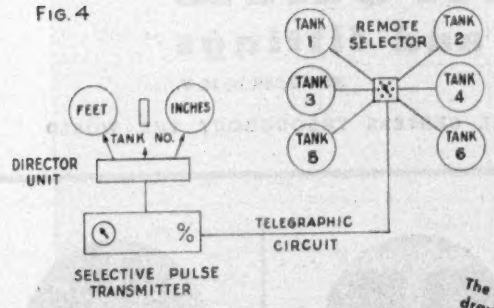
FIG. 1

VARIOPLEX is the essence of simplicity. You may have your readings simultaneous or sequential. In electrical circuits, you may have as little as one wire and ground, or more as desired. You may transmit by wire, micro-wave or radio. The system employs the start/stop, step by step method of telegraphic transmission. The system has great potential for expansion into the fields of supervision and control.



The drawing shows the arrangement of an S. & J. Automatic Tank Gage with VARIOPLEX sprocket housing and transmitter. If you have S. & J. or any other make of Automatic Tank Gages employing perforated metal tapes, you can use the VARIOPLEX with existent installations.

FIG. 4



The complete story, with numerous drawings of circuits, is contained in Catalog No. VG-353. Request a copy on your business letterhead.

Shand and Jurs Co.
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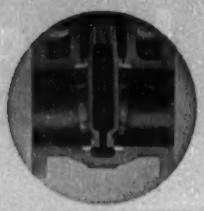
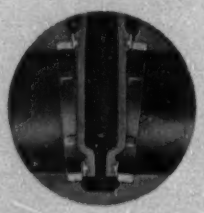
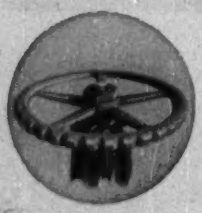
ENGLAND: Whessoe, Ltd., Sales: 25 Victoria St., London, S.W. 1
Whessoe, Ltd., Mfrs: Darlington, County Durham



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.



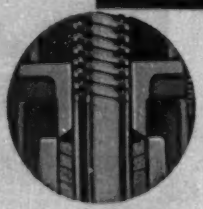
Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features



Brass Liner on Glands assures greater resistance to corrosion and scoring.

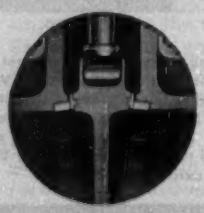
For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.

WALWORTH

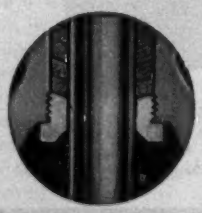
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

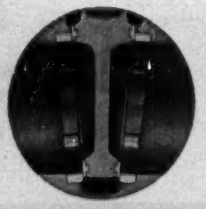
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



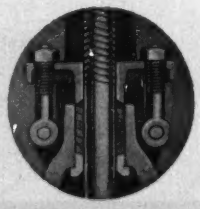
T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



Bronze Back-Seat Bushings in bonnets of OS&Y valves.



Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

How to Select the Best Ion Exchangers

FOR YOUR SPECIFIC APPLICATIONS

Permutit Ion Exchangers and Equipment are now being used successfully in copper and zinc recovery from textile wastes, metal recovery from plating wastes, and in sugar, chemical and antibiotic manufacture, as well as many other fields.

New uses that have profit-producing possibilities for your own processes include:

REMOVAL of impurities from solutions

CONCENTRATION for profitable recovery

SEPARATION of substances from each other

SUBSTITUTION of specific ions for others in solution

CATALYSIS of chemical reactions

To select the best cation or anion exchangers for your specific purpose, examine the table below. The Permutit Company will be pleased to furnish further information on both the application and the ion exchangers most suitable—along with samples for your experimental work. Write today.

The Permutit Company, Dept. CE-8, 330 West 42nd Street, New York 36, N. Y. or Permutit Company of Canada, Ltd. 6975 Jeanne Mance Street, Montreal.

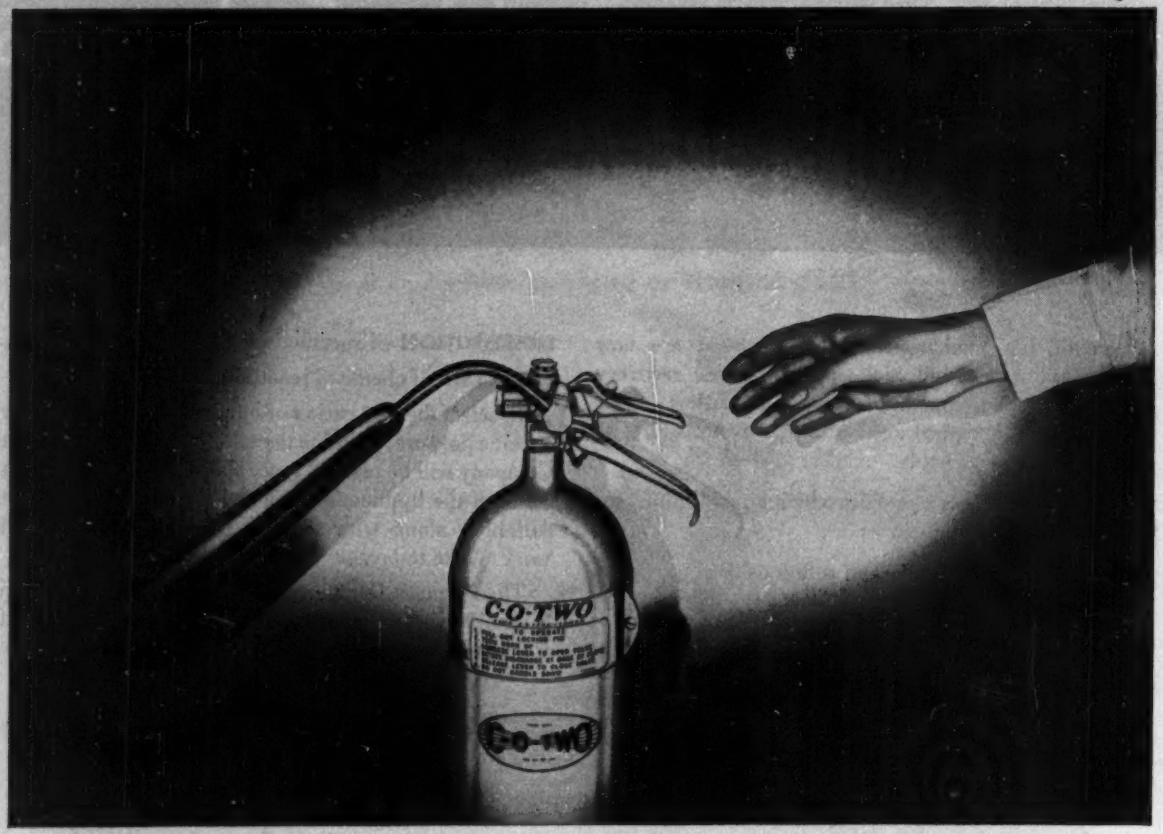
	CATION EXCHANGERS				ANION EXCHANGERS				
	Zeo-Dur*	Decalso*	Zeo-Karb*	Permutit Q	De-Acidite*	Permutit W	Permutit A	Permutit S-1	Permutit S-2
Chemical Stability to acids			x	x	x	x	x	x	x
to alkalies				x	x	x	x	x	x
to oxidation				x		x		x	x
to temperature				x		x		x	
to organic solvents	x	x		x		x	x	x	x
Physical stability	x	x	x	x	x	x	x	x	x
For removal of weak acids							x	x	x
For removal of strong acids					x	x	x		
For high regeneration efficiency			x	x	x	x			x
For high capacity		x		x	x		x		x
For low initial exchanger cost	x	x	x		x		x		
pH range (operating)	6.2-8.7	6.9-7.9	0-11	0-13	0-12	0-13.9	0-13.9	0-13.9	0-13.9
For high porosity		x	x		x				
For hydrogen exchange low pH			x	x					
For salt splitting							x	x	x

x = generally recommended

*Registered trade marks

MANUFACTURER OF ION EXCHANGERS AND EQUIPMENT FOR OVER 40 YEARS

PERMUTIT



Handclasp of a friend-in-need

There's confidence in the very "feel" of the world famous C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers. The quick-acting "Squeez-Grip" fits your hand naturally like a handclasp ... hangs right ... carries right ... works right. You're in complete command of the situation instantly ... no fumbling ... no fatigue.

From the non-conducting, shatterproof discharge horn to the high strength, durably finished cylinder, you get top quality construction that results in a lifetime of satisfactory service. Because of the very few working parts and corrosion resistant materials throughout, the total cost to you over the years is less than other initially lower priced makes ... fire after fire, recharge after recharge, without trouble.

It's not hard to see, when you fully compare and try, why C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers are your best buy for killing flammable liquid and electrical fires, as well as some surface fires involving ordinary combustible materials. Sizes range all the way from 2½ to 100 pounds capacity ... all fully approved by the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Armed Forces and Government Bureaus.

With C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers the penetrating carbon dioxide is a clean, dry, non-damaging, non-conducting, inert gas ... smothers fire instantly, leaves no after fire mess ... harmless to equipment, materials and finishes ... even food is still perfectly edible.

Act now for complete free information on these first-rate, sure-acting fire extinguishers. Remember fire doesn't wait ... get the facts today!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-in High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
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C-O-TWO FIRE EQUIPMENT COMPANY
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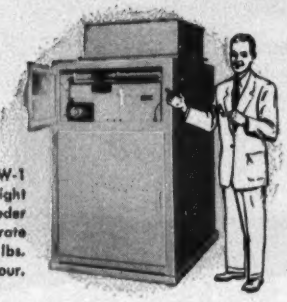
Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

Model GLW-O
Loss-in-Weight
Gravimetric Feeder
for maximum rate of
100 lbs. per hour.

NEW FEEDER
...for process systems

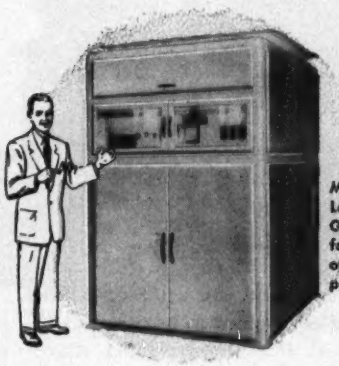


Model GLW-1
Loss-in-Weight
Gravimetric Feeder
for maximum rate
of 1,000 lbs.
per hour.

This Omega Model GLW-O is a small gravimetric feeder for dry materials. It incorporates all the quality features that have made Omega Feeders of this type famous throughout the Chemical Industry. Omega offers the only COMPLETE line of Loss-in-Weight Gravimetric Feeders.

FEATURES

- High accuracy — within ±1% by weight
- Wide feeding range (100 to 1)
- Hairline feed rate adjustment (up to 100 lbs. per hour) from a single dial
- Large hopper capacity — 5 cu. ft.
- Sentinel alarms to warn of over or under feeding
- Direct reading totalizer shows amount of material fed
- Easily adapted for automatic proportional pacing with chemical feeders, proportioning pumps, flow meters, process machinery, etc.
- Enclosed, dust-tight housing . . . interior cabinet illumination.



Model GLW-2
Loss-in-Weight
Gravimetric Feeder
for maximum rate
of 4,000 lbs.
per hour.

Want more facts?

Send Coupon

OMEGA MACHINE COMPANY
369 Harris Ave., Providence 1, R. I.

- ☐ Send Bulletin 30-K4 giving full details on Omega Model GLW-O Loss-in-Weight Gravimetric Feeder for dry materials.
- ☐ Send Bulletin 30-H12 — describing Models GLW-1 and GLW-2 Loss-in-Weight Gravimetric Feeders (for larger capacities).

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Company.....

Street.....

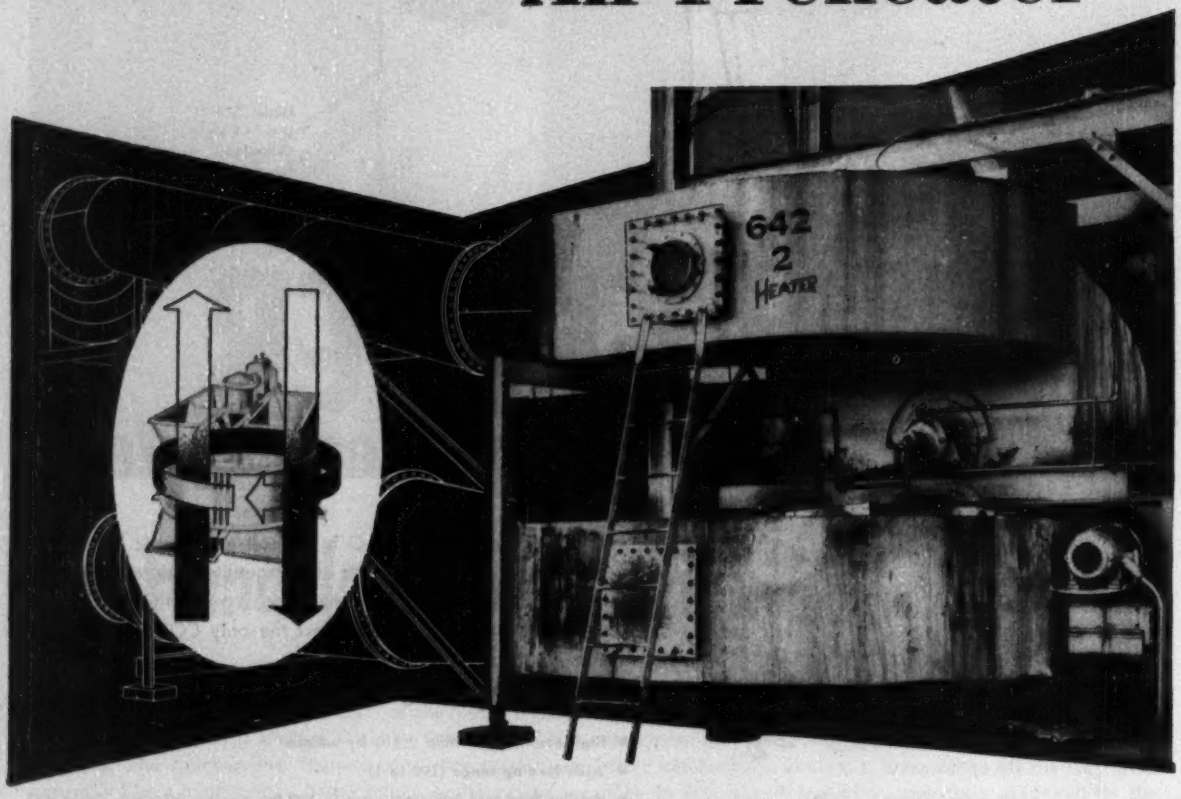
City..... State.....

OMEGA

THE LAST WORD IN FEEDERS

Replace Still Convection Surfaces...

...with a Ljungstrom Air Preheater



in purchasing new equipment — or modernizing existing equipment — one way to save impressive amounts of capital as well as operating expense is to design for a Ljungstrom Air Preheater.

Because the Ljungstrom promotes such greatly increased heat liberation in the furnace, the convection bank of oil tubes can generally be eliminated from the design. This can in itself *more than pay the cost of the Ljungstrom installation.*

Add to this the proved fuel savings ... the higher product quality ... greater throughout possible with a Ljungstrom — and you will see why the Ljungstrom is an eminently practical piece of equipment to be considered wherever fuel is burned.

Wherever You Burn Fuel, You Need LJUNGSTROM

In these days of high fuel costs and skyrocketing demands for petroleum products, every refinery should consider a Ljungstrom whenever equipment is being purchased or modernized. Call or write The Air Preheater Corporation for complete details.

THE AIR PREHEATER CORPORATION
60 East 42nd Street, New York 17, N. Y.

STURTEVANT ROTARY FINE CRUSHERS

Crush or Granulate to Fine, Even Sizes without Excess Dust...

Cross section view illustrating the crushing action

These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine . . . crush fast and do not clog. Available in output capacities from 1 to 30 tons-per-hour. Write for catalog.

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Please send me catalog describing your Rotary Fine Crushers. I am interested in crushing_____

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NEWS ABOUT "TEFLON"

How Valve Components of Du Pont "Teflon"* Are Giving Improved Performance at Less Cost

Ever since Du Pont "Teflon" tetrafluoroethylene resin was developed, it has found an ever-increasing use as a material for valve components — gaskets, packings, seats and discs, plug valve components and diaphragms. It provides a unique combination of properties which are of particular interest to manufacturers and users of valves. Among these properties are:

- **CHEMICAL INERTNESS**

  Du Pont "Teflon" is completely unaffected by acids, alkalis, aliphatics, aromatics, chlorinated hydrocarbons . . . *all* chemicals except molten alkali metals, and fluorine at elevated temperatures.

- **HEAT RESISTANCE**

  Gives continuous service up to 500°F.

- **LOW-TEMPERATURE TOUGHNESS**

  Has been used satisfactorily at temperatures as low as—320°F.

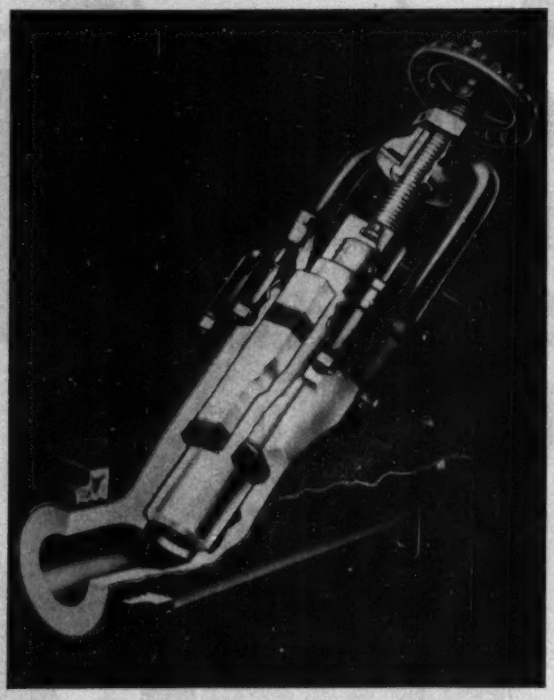
- **LOW COEFFICIENT OF FRICTION**

  Lets the valve operate more easily. Eliminates the need for lubrication.

- **EROSION RESISTANCE**

  Resists erosion by impinging fluids.

Here are some examples that show how valve components of Du Pont "Teflon" give outstanding performance and long service life . . . decrease production downtime, provide important savings in labor and material.



Chemical porcelain valve manufactured by the Lapp Insulator Co., Inc., Le Roy, N. Y.

GASKETS AND PACKINGS

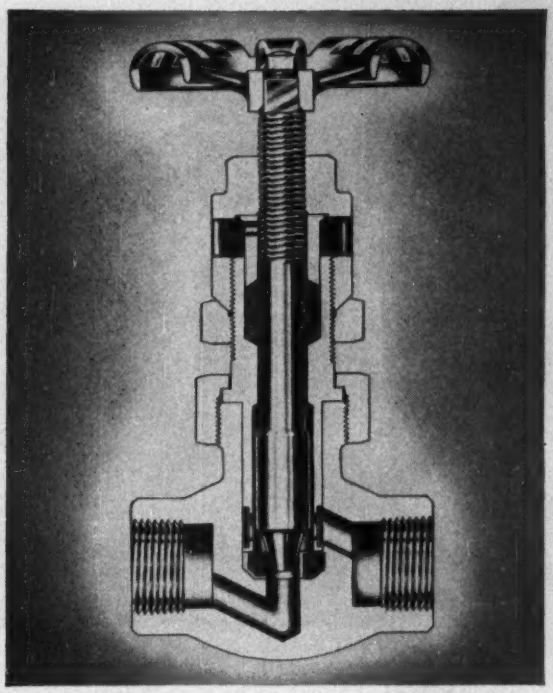
Gaskets and packings of Du Pont "Teflon" give outstanding performance—often last longer than the valve itself.

Packings of "Teflon" are now available in braided, bulk, impregnated, woven asbestos, extruded and molded forms. With such packings, gland nuts require only a minimum of tightening to achieve a tight seal. Less torque is required to operate the valve. In some cases such packings have permitted the miniaturization of the packing gland.

Gaskets of "Teflon" are now available in many forms, which include solid, jacketed, spiral wound, and asbestos and glass types impregnated with "Teflon." Many users have now standardized on packings and gaskets of Du Pont "Teflon."

Valves with components of Du Pont "Teflon" are being used by manufacturers and processors of:

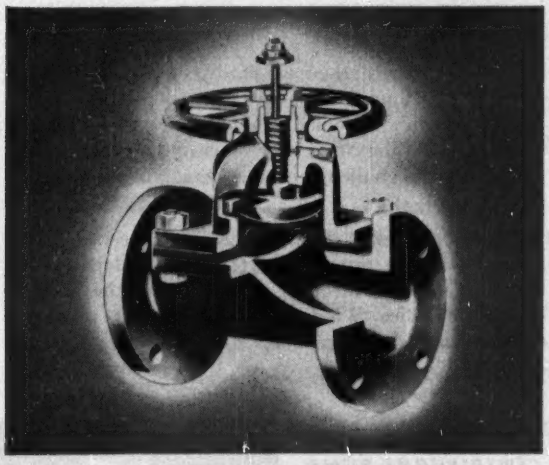
CHEMICALS	CHLORINE	DYES	EXPLOSIVES
FERTILIZERS	FOODS	INSECTICIDES	PAPER
PETROLEUM	PLASTICS	RUBBER	PHARMACEUTICALS
SOAP	SUGAR	TEXTILES	PHOTOGRAPHIC FILM



Needle valve manufactured by
Alloy Steel Products Co., Linden, N. J.

SEATS AND DISCS

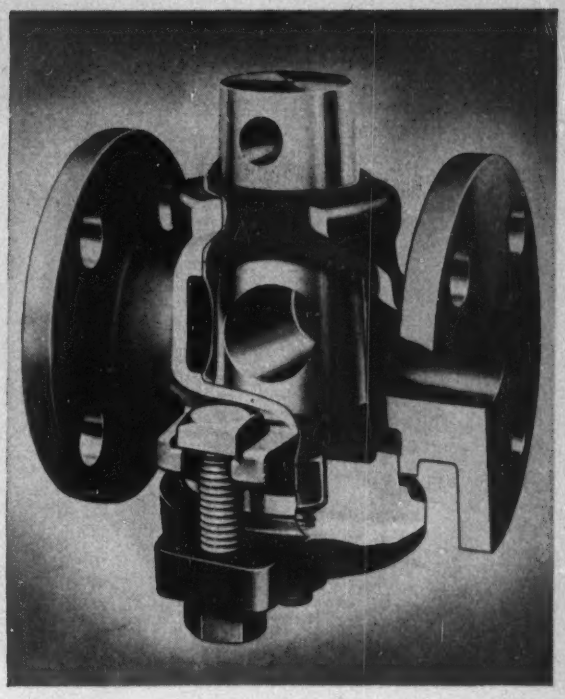
The success of "Teflon" in gaskets and packings led to its use as a seat and disc material. The use of "Teflon" has reduced the cost of manufacturing many types of valves by eliminating the need for lapping the disc into the seat, making valve parts interchangeable and simplifying design. Du Pont "Teflon" gives better performance where hot and corrosive materials are handled.



Saunders-Patent valve manufactured by
Hills-McCanna Co., Chicago, Ill.

VALVE DIAPHRAGMS

The chemical inertness and thermal stability of Du Pont "Teflon" have recently led to its development and use as a valve diaphragm. This diaphragm is pure "Teflon," and has been designed for continuous operation at pressures of 100psi and temperatures of 400°F.



Plug valve manufactured by
The Duriron Co., Inc., Dayton, Ohio

PLUG VALVE COMPONENTS

Used in plug valve components, Du Pont "Teflon" is especially valuable because of its low coefficient of friction and non-adhesive characteristic. These properties prevent the plug cock from sticking or freezing in the valve body. Before "Teflon" was developed, this problem was often overcome but required intricate design and costly fabrication. With "Teflon," these plug valve components have simplified design and are produced inexpensively. In one case, a plug valve sleeve was developed, and in another, a plug cock washer was used. In both cases, Du Pont "Teflon" gave excellent results.

The Polychemicals Department of the Du Pont Company supplies "Teflon" in the forms of molding powders and aqueous dispersions. These forms are converted into various valve components and molded articles by a number of manufacturers for use in chemical and allied equipment. For further information, write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 258 Du Pont Bldg., Wilmington 98, Delaware.

*REG. U. S. PAT. OFF.

DU PONT
REG. U. S. PAT. OFF.
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...THROUGH CHEMISTRY
Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

What have you learned since 1921?

Lots of things have happened in the last three decades, and nobody who has lived through them can have failed to acquire a great deal of valuable information and experience.

That's why it's important to you that the first LaBour self-priming centrifugal pump was sold in 1921—more than thirty years ago. The problems of those thirty years, the things we've learned the hard way about design and casting, make today's LaBour pumps more dependable, more efficient, more useful in more ways throughout the chemical industry.

Today, of course, there are many copies and adaptations of LaBour, so far as patent laws permit. The thing that can't be copied, and for which there is no substitute, is thirty-two long years of doing the job—meeting the challenge of new demands day after day.

Because unfailing continuity of pump service is so important in process plants, LaBour dependability as proved through the years, is the wise engineer's choice. When you can't afford to take a chance, you take a LaBour.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.

FOAMGLAS stays dry to protect GULF spheroid from corrosion

Preventing corrosion was of prime importance in designing and constructing four Hortonspheroids at the Gulf Oil Corporation's Refinery, Port Arthur, Texas. Gulf reports "To combat corrosion while maintaining constantly the 50° F. temperature required for the butane stored in these spheriods, we chose to insulate them with FOAMGLAS because its sealed glass cells insure that it will *stay dry.*"

You, too, will find FOAMGLAS ideal for your insulating requirements. Consider its other outstanding benefits so important in petroleum refining . . . fire and acid proof . . . will not rot . . . high compressive strength. Use the coupon now to discover how *you* can use FOAMGLAS to meet your insulating needs.

PITTSBURGH CORNING CORPORATION

One Gateway Center • Pittsburgh 22, Pa.

Installation: Surface sandblasted and bonded with zinc chromate, then spray coated with ⅛" of fibrated asphalt cut-back. Standard 2" x 12" x 18" blocks of FOAMGLAS impaled on Nelson welding pins, secured with speed clips, pointed and coated with fibrated asphalt cut-back. Entire outer surface covered with aluminum paint as weathering agent.

Insulation Contractor: Thermal Products Company, Houston, Texas.

PITTSBURGH PC CORNING

Pittsburgh Corning Corp., Dept. H-83
One Gateway Center • Pittsburgh 22, Pa.

Please send me free sample and booklets on use of FOAMGLAS for:

- ☐ Steam Lines
- ☐ Refrigeration Lines
- ☐ Equipment

☐ Send engineer to discuss specific problem
☐ Advise nearest source of supply

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Put up to Stay up

trouble free service for over 22 years

... that's only one record for...

GRID

UNIT HEATERS

That's the statement of a large eastern chemical plant. Their letter to us continues: "We have found that cast iron construction stands up very well against the corrosive fumes of HCl, Cl_2, etc. . . . the unit heaters that have copper tubes give trouble due to corrosion in a few years . . . we consider GRID Unit Heaters satisfactory and would certainly recommend them for installation where corrosive acid fumes exist". Such service record occurs because GRID is completely different from other unit heaters — here's how:

GRID is an all cast unit with finned heating sections and headers tested to withstand steam pressures up to 250# P.S.I.

GRID construction uses no brazed, soldered, rolled or welded connections between condenser and headers. A specially designed threaded nipple assures a precision, leakproof fit.

GRID construction has all similar metals in contact with steam thus preventing electrolytic corrosion which eventually occurs in copper type unit heaters where steam passes from iron pipes into copper cores. (Write for booklet CORROSION IN UNIT HEATERS.)

GRID construction resists corrosion from corrosive acid fumes that exist in chemical plants.

GRID design incorporating low outlet temperatures, proper fan sizes and motor speeds, assures delivery of warm comfortable air in ample volume to the working level. No stratification of warm air at the ceiling to waste your fuel dollars.

GRID BLAST COILS ARE IDEAL FOR MANY USES THROUGHOUT CHEMICAL PROCESSING INDUSTRIES—WRITE FOR CATALOG BC-1040.

These are the reasons why users of GRID Unit Heaters get 22 years and more of trouble-free service. There are units cheaper than GRID, but there is none better. You start saving money the day you install GRID Unit Heaters.

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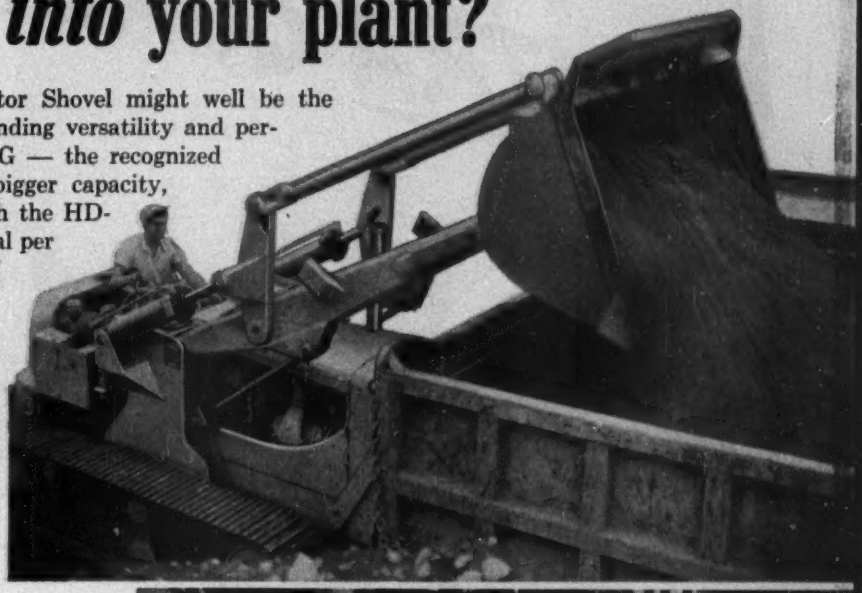
D. J. MURRAY MANUFACTURING CO.

MANUFACTURERS SINCE 1883 • WAUSAU • WISCONSIN

MR. PRODUCTION MANAGER:

are you looking for a way to feed more output capacity *into* your plant?

This Allis-Chalmers HD-9G Tractor Shovel might well be the answer. It offers the same outstanding versatility and performing ability as the 1-yd. HD-5G — the recognized standard of comparison — *plus* bigger capacity, higher reach and more power. With the HD-9G, one man can move more material per shift . . . handle a wider variety of jobs inside and out.

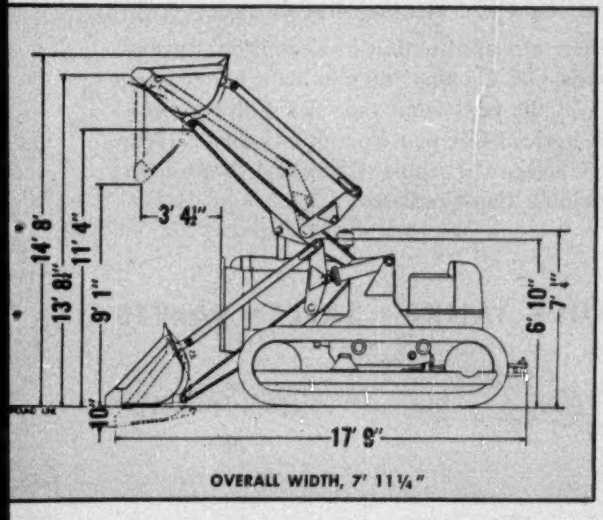


loads fast with big two-yard bucket

The HD-9G digs, stockpiles, loads trucks, feeds hoppers — handles any bulk material two big yards at a scoop. Special 3½-yd. light materials bucket almost doubles output in materials weighing not more than 1400 lb. per cu. yd. Exclusive Allis-Chalmers shift pattern further speeds loading by allowing operator to go from low forward to fast reverse with one simple gear shift.

high dumping height — 11 ft. 4 in. Under Bucket Hinge

Here is a Tractor Shovel that reaches for extra jobs. With bucket fully raised, it dumps into high bins. Also, tractor can work right up on storage piles, making it possible to put many more yards of material in a given area.



OVERALL WIDTH, 7' 11¼"

works in close quarters — No Bulky Superstructure

Compact design, plus the ability to turn in its own track length enables the HD-9G to work in confined areas or where there is little more than tractor-height head room.

powerful — 72 brake hp.

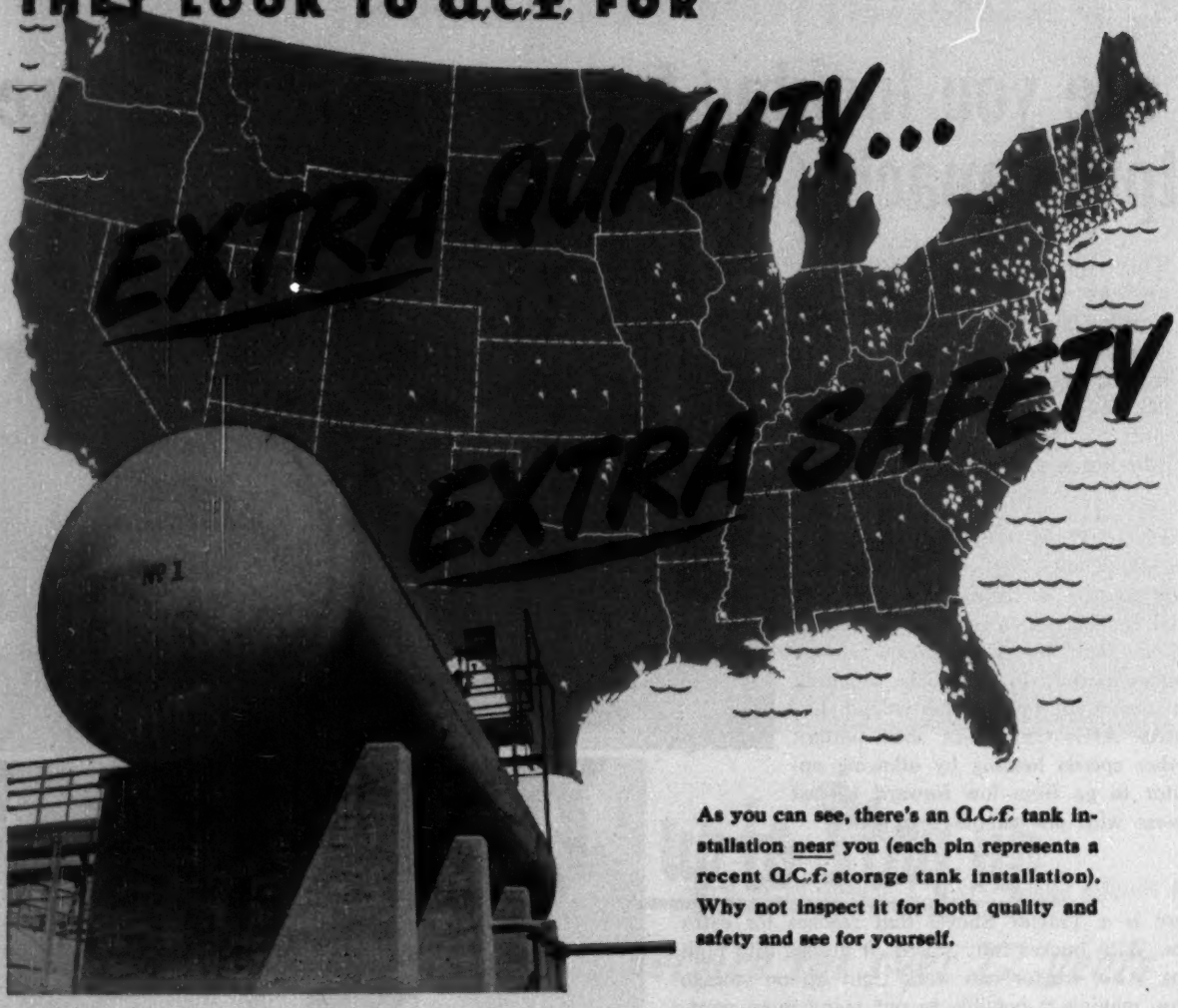
The HD-9G has the power, weight and traction to handle tough excavating on new construction, maintain yard roads and parking lots, spot railroad cars, lift, carry, push or pull heavy loads of all kinds.

Ask your Allis-Chalmers Dealer to show you the many ways this HD-9G has helped others step up production.

ALLIS-CHALMERS

TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

THEY LOOK TO A.C.F. FOR



As you can see, there's an A.C.F. tank installation near you (each pin represents a recent A.C.F. storage tank installation). Why not inspect it for both quality and safety and see for yourself.

. . . FROM A GIANT 118,000 gallon multi-tank installation at Mt. Pleasant, Iowa to a 1,500 gallon job at Woodensburg, Maryland . . . you'll find that operators depend on A.C.F. craftsmanship to deliver the extra safety they need to take full advantage of the choicest and most convenient locations.

A.C.F. quality grows from the skill of technicians, researchers and craftsmen plus constant inspection such as the x-ray check of every inch of the welded seam and stress-relief of every tank.

By consistent application of exceptionally high standards, A.C.F. helps you eliminate unnecessary risks. Get the facts from your A.C.F. Representative. American Car and Foundry Company, New York · Chicago · St. Louis · Cleveland · Washington Philadelphia · San Francisco.

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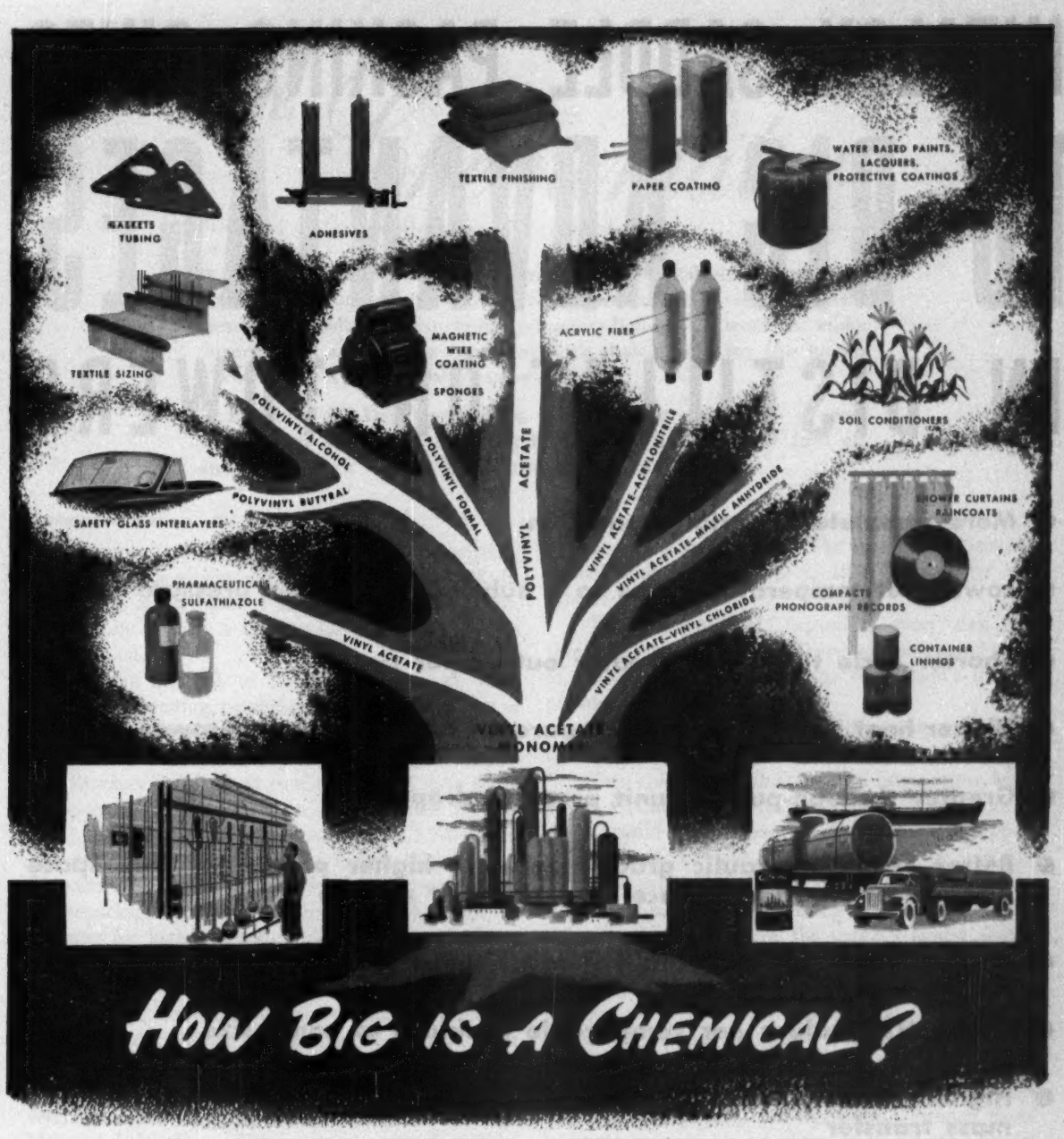

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How big is a chemical? As large as its production volume . . . as broad as its applications. Vinyl Acetate Monomer—the basis for countless plastic products, paints, paper, textiles, pharmaceuticals, adhesives—is big. With the start of full-scale production at the Celanese Pampa plant, Vinyl Acetate gains a bigness that opens the door to more intensive research, far-reaching product development.

Celanese Vinyl Acetate Monomer—ready in tankcar quantities within a few weeks—will be produced by specially developed processes, utilizing Celanese-produced raw materials, in the newest, most up-to-date petrochemical plant in the country. Two grades of monomer will be available: A-grade, stabilized with diphenylamine, and H-grade, inhibited with hydroquinone.

The possibilities and opportunities for vinyl acetate derivatives warrant thorough investigation. We will be glad to assist you with complete technical data and literature. Write:

Celanese Corporation of America, Chemical Division, Dept. 553-H, 180 Madison Avenue, New York 16, N. Y.

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INTALOX SADDLE PACKING GIVES 10 BIG ADVANTAGES IN DISTILLATION TOWERS

- More complete material separation
- Lower pot temperatures due to a substantially lower pressure drop
- Shorter cycle time with greater output per cycle
- Higher heat input efficiency compared to any other type of tower packing
- Greater through-put per unit pressure drop
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- Less tendency for wall channeling of reflux liquor
- Lower HTU values per comparable packings of same size
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Prepared under the direction of Joseph A. O'Connor, News Editor

• By a new high-temperature vapor-phase catalytic chlorination and cyclization process Hooker Electrochemical, starting with pentane, produces hexachlorocyclopentadiene. It's used to make insecticides, and can be combined with maleic acid for the manufacture of alkyd and polyester resins.

• Standard Oil Development Co. has come up with a new process for further materially reducing the production of heavy fuel oil in refineries. It utilizes a fluidized solids technique.

Ceramics: avenue to atomic power?

Ceramic research, which plays an ever increasing role in the development of atomic energy, will be intensified at the Oak Ridge National Laboratory, operated by Carbide & Carbon for the Atomic Energy Commission.

Finding materials of construction that can withstand the operating conditions in nuclear reactors is one of the outstanding problems in the development of atomic power. Ceramics may provide an answer.

Reactors operating at over 800 deg. F. may prove to be the most economical for nuclear power production. Most metals can only be used below 1,500 deg F. But ceramics can withstand far higher temperatures. In particular, they hold promise for use in low-cost power-package reactors. Thus the development of ceramics for high-temperature work, where metals or alloys are unsuitable, is essential to the future of nuclear energy for the nation.

Cermets, combinations of ceramics and metals, are likely materials for construction of reactors. But investigation of cermets will be only part of the research that a team headed by Dr. J. M. Warde, veteran ceramic expert, will carry on at the Oak Ridge National Laboratory. Other important work will be done on oxide, boride and nitride ceramics as structural materials, on techniques for applying ceramic coatings to materials used in reactors, and on the evaluation of the effects of radiation damage on ceramics.

Pentagon's power of total recall

By the snap of a Pentagon official's finger over 25 percent of the engineers and scientists now in productive defense work, development and research could be put in uniform. That's the warning sounded by Du Pont's Dr. Thomas H. Chilton, former president of the American Institute of Chemical Engineers and chairman of the Engineering Manpower Commission.

A compulsory reserve has been created by Public Law 51 into which military personnel go upon completing their active service. This includes all Selective Service inductees as well as ROTC graduates and others.

This reserve pool, expanding every day, will shortly exceed 10 million. It includes more and more of those men who are vital to the nation's defense production economy.

Calling these men back to active duty rests solely in the hands of the Department of Defense.

This unbalanced situation, the Engineering Manpower Commission of the Engineers Joint Council warns, could create chaos in the industrial support of mobilization. The current shortage of scientific and technical manpower only underscores the risk.

That's why the Engineering Manpower Commission, together with 10 of the nation's largest professional and industrial organizations, is calling for action on the recently introduced Flanders-Johnson bill. It provides for a manpower board to be set up in the Office of the President, and for a more selective system of recalling reservists.

Not only engineers and scientists but industry and labor are backing the legislation. Among those in agreement with its principles are the Armed Forces Chemical Association, the American Institute of Chemists, the Scientific Manpower Commission, the American Chemical Society and the Manufacturing Chemists' Association. All are joining the Engineering Manpower Commission in urging immediate hearings on the Flanders-Johnson bill.

How much do engineering graduates get paid?

Engineers graduating from Columbia University this year can expect to start at about $4,300, compared with 1952 graduates in engineering whose average starting salary was $4,000 yearly. These salaries are for engineers with a B. S. only. Those with an M. S. start at an average of $500 a year more.

(Continued on page 106)

THE CHEMENTATOR, continued

Salaries show a steady upturn from 1950 onward. Engineering graduates of Columbia in 1950 averaged between $3,000 and $3,500, in 1951 between $3,500 and $4,000, and in 1952, $4,000.

Engineers stay put if they like their job. Of the Columbia group surveyed, 71 percent were still with the companies they joined upon graduating. The rate of turnover, highest among civil engineers, was lowest among chemical engineers.

Butadiene: producers strain to meet demand

Continued high demand and a possible price increase for butadiene are forecast by Esso's Osgood V. Tracy. That's the outlook presented to CMRA members in New York recently by Tracy, who is president of Enjay and manages Esso's production of chemicals.

Total U. S. butadiene capacity, installed or under construction, is 852,000 short tons a year. Of this, 754,000 short tons is in government plants—215,000 from alcohol, 539,000 from petroleum. In addition, privately owned plants are estimated to have a total capacity, installed or under construction, of 98,000 short tons of butadiene from petroleum, as represented by Dow, Esso, Carbide & Carbon and Publicker.

Among the petroleum plants, the Port Neches, Tex., plant dominates, with 31 percent of the total capacity for butadiene from petroleum. It is currently operated by Neches-Butane Products Co., jointly owned by Atlantic Refining, Gulf Oil, Pure Oil, Socony-Vacuum and Texas Co.

Biggest outlet for butadiene today is in GR-S synthetic rubber, which takes 611,000 short tons. The requirement for butadiene to make nitrile rubber, 15,000 tons, is small but important. Unlike GR-S, nitrile is produced, not by the government, but privately by Goodrich, Goodyear, Firestone and U. S. Rubber.

Butadiene, as an alternate raw material instead of benzene, cyclohexane or furfural, is used to make nylon. Latex paints, with polymers of butadiene and styrene in latex form as their principal ingredient, are a fast growing outlet for butadiene. And polymers of butadiene alone, or combined with styrene and acrylonitrile, produce resins for coatings and other purposes. These three markets, in nylon, latex paints and resins, take about 65,000 short tons.

Thus the total requirement for butadiene, Tracy estimates, is for 691,000 short tons.

At present, with synthetic rubber production continuing high, all plants for making butadiene from petroleum, both government and private, cannot meet this demand for 691,000 tons. This means 54,000 tons a year will have to come from alcohol or from more expansion of petroleum butadiene plants.

For these reasons, butadiene, recently selling for about 15 c. a lb., f.o.b. works, is likely to increase in price. For one thing, if the 54,000 tons comes from alcohol, as Tracy points out, it will almost surely cost more than butadiene from petroleum. Secondly, if the government butadiene plants are sold, it's unlikely that private industry can make butadiene as cheaply as the government, which pays no taxes and has little or no marketing or development expenses.

Bright future for synthetic polymers

Use of synthetic polymers will show more than a fivefold growth from 1950 to 1975. And free radical vinyl polymerization will be the backbone of the synthetic polymer industry in the future, according to Dr. S. M. Cadwell, research director of U. S. Rubber. A sixfold increase in polymer production by free radical vinyl polymerization is expected by 1975.

Production of synthetic polymers is a big and growing business. Synthetic high polymers account for almost 30 percent, or about $2.4 billion, of the $8 billion worth of chemicals produced in 1950 by the chemical industry in the United States.

Adding up the value of 1950 production of the 26 largest synthetic chemical raw materials—chemicals like alcohol, benzene, chlorine, acetylene and others—gives a total of only $1.1 billion. The $2.4 billion value of the synthetic polymers is more than twice that total. Interestingly, the value of synthetic polymer production is more than one-fourth the value of automobile production.

The rapid growth of the synthetic polymer industry, Cadwell prophesies, is just starting. Synthetic polymers came on the market about 1930, grew slowly until 1940, and then began to grow rapidly after 1940. These polymers, including synthetic rubber, synthetic fibers and synthetic plastics, will have an important future role in U. S. industry.

New Canadian producer to make polyethylene

As part of Canada's current $100 million petrochemical expansion, Canadian Industries Ltd. is erecting a $13 million polyethylene plant on a 30-acre site near Edmonton in Alberta. The plant will gobble up 13,000 tons of ethylene per year.

Operations at the Edmonton plant will require about 10 million cubic feet of natural gas, 8 million gallons of water and 35,000 kwh. of electricity a day. More than 200 will be employed.

At first, refineries in eastern Canada near the markets for polyethylene were considered as sources of ethylene for making the plastic. But there was no guarantee of continued supply beyond a few years. As it turned out, the advantages of locating the plant in eastern Canada close to market were outweighed by the advantages in Alberta.

Added freight charges on polyethylene shipped from Alberta will be more than offset by a virtually unlimited supply of ethylene at lower cost. And fuel costs will likewise be lower. (*Continued on page 110*)

Everywhere you LOOK..

INSUL-MASTIC Coatings Provide Long-Lasting Protection

Practically every pipe and vessel in the plant section above is coated with INSUL-MASTIC, to prevent corrosion.

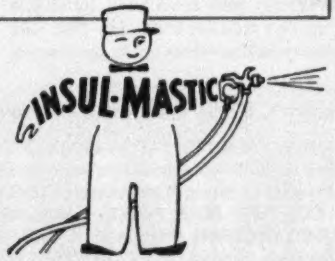
Acid vapors rain almost constantly over the steel structures in the photograph. That is why INSUL-MASTIC was chosen several years ago to keep this equipment from corroding. Acid laden water used to quench burning coke, picks up more acid from the coke and fills the air with clouds of corrosive steam. It is more than ordinary protection can stand, but INSUL-MASTIC has very capably resisted these acid vapors for years. It will continue to prevent corrosion here for many, many more years.

In chemical plants everywhere INSUL-MASTIC is preventing destruction by acids, alkalis and moisture vapor. These tough coatings are unharmed by sunlight and weather. They can be sprayed over bare metal or over insulation. They keep moisture and corrosive chemicals from destroying tanks, pipes, other chemical vessels and supporting structures.

These long-life coatings can greatly reduce your maintenance operations and extend the life of your equipment. Write today for the address of your nearest INSUL-MASTIC representative.

think first of the coatings that last!

TAKE ADVANTAGE OF OUR CONSULTANT SERVICE. Don't risk needless future maintenance. Our engineers can tell you whether or not your construction or insulation needs a protective coating. There is no obligation. Write today!



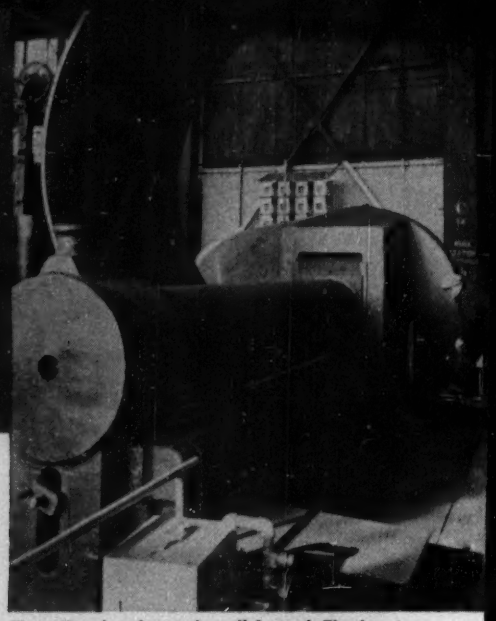
Insul-Mastic

CORPORATION OF AMERICA

Oliver Building • Pittsburgh 22, Pa.

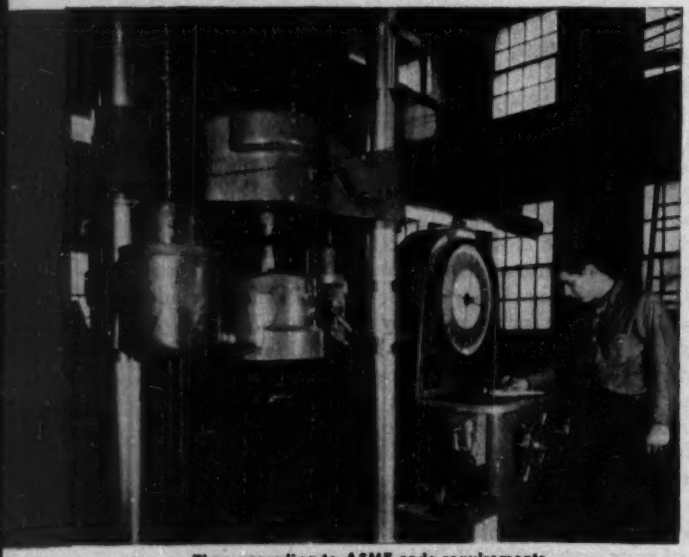
Representatives in Principal Cities

Here's how an Autoclave gets its start. This 3 11/16 inch thick plate is being laid out for a 500 gal. x 1875 psi carbon steel Autoclave.



Then, the plate has to be roll-formed. The forming machine used here is of the most modern type.

This is how Blaw-Knox builds an Autoclave



Then according to ASME code requirements, the Autoclave body is given the Tensile Test.

BLAW-KNOX craftsmen have at their command the most modern facilities available for the fabrication of processing equipment to *any* specifications. Equally important as these physical assets are long experience and ingenuity in design and unequalled skill in fabricating reaction vessels for every purpose. High performance, maximum safety and ruggedness for long life are built into every piece of Blaw-Knox equipment. Glad to discuss the requirement for any process you may be considering.

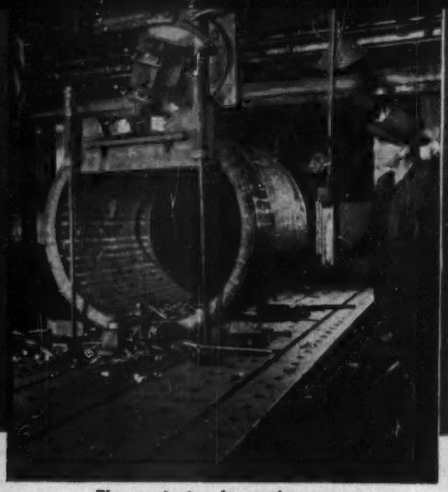
• • •

Bulletin 2413 brings you complete information on Blaw-Knox Autoclaves. Write for your copy today.

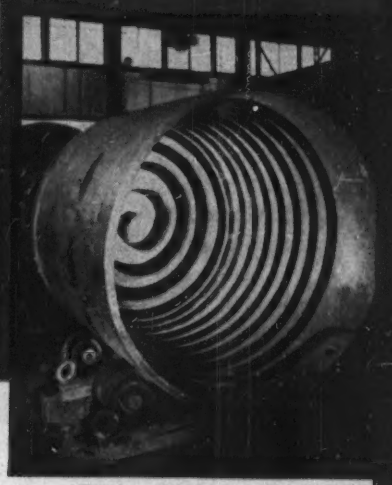
BLAW-KNOX *offers you competent experience in the design and fabrication of:*

AUTOCLAVES for any pressure, temperature or reaction • ELECTRO-VAPOR HEATING SYSTEMS for vessels and kettles of all types • QUICK-OPENING DOORS for vulcanizers, impregnators, etc. • AGITATOR and AGITATOR ASSEMBLIES engineered to meet all mixing requirements • CONTACTORS • PACKAGED HEATING AND COOLING UNITS • COMPLETE RESIN PLANTS • VULCANIZERS • DIGESTERS in any capacity for any purpose • COMPLETE CHLORINE AND CAUSTIC SODA PLANTS • PILOT PLANTS that supply data required for full-scale production • COMPLETE UNITS FOR VEGETABLE OIL EXTRACTION AND PROCESSING • HANDHOLES • MANWAYS • STUFFING BOXES • HEAVY WELDMENTS.

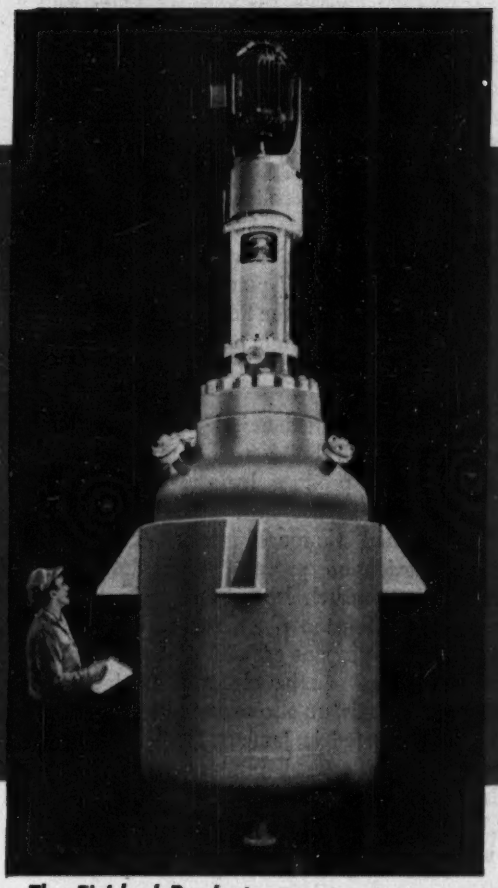
After forming, the plate is fit-up and tack welded.



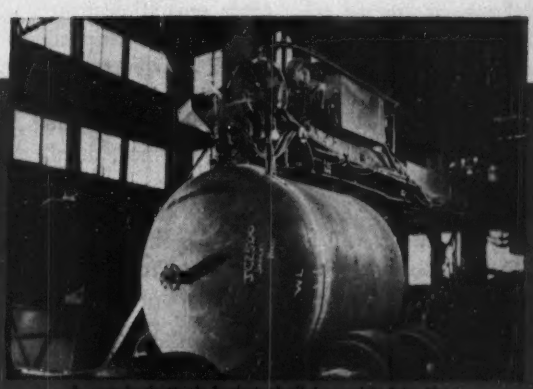
The next step is precise machining of the Autoclave body.



The Autoclave-to-be is then fitted with a spiral jacket baffle.



The Finished Product — Tested under actual operating conditions and ready for shipment. This 500 gal. 1875 psi unit will be used for the processing of an additive for aviation gasoline.



A one-inch thick jacket shell is welded to its end which becomes the base of the Autoclave.

X-ray equipment that can detect the slightest flaw is used to test the girth weld.

BLAW-KNOX

BLAW-KNOX COMPANY
BLAW-KNOX EQUIPMENT DIVISION
PITTSBURGH 22
PENNSYLVANIA

The actual plant site near Edmonton was picked because gas from the Leduc-Woodbend field had the right composition, the field had prospects of further development, and nearby Edmonton had rail facilities, housing and labor.

Wet gas from the Leduc-Woodbend field is processed at the Devon plant of Imperial Oil Ltd., about 20 mi. south of Edmonton. After processing, dry gas is delivered via pipeline to the city of Edmonton for fuel.

High-purity ethylene for the manufacture of polyethylene will be made from the raw material gas stream by a process developed by the Lummus Co. of New York, which designed the ethylene unit.

Feed gas from the Devon-Edmonton pipeline will be metered into CIL's ethylene plant. There the ethane in the gas will be absorbed by a stream of liquid hydrocarbons, or sponge oil. After separation from the unabsorbed gas the sponge oil will be stripped of ethane and recycled.

The ethane will be cracked to ethylene in radiantly heated alloy steel tubes. The resulting ethylene will be separated by fractional distillation, purified, dried, liquefied and stored at about 550 psi.

Hydrogen produced, together with some of the gaseous hydrocarbons, will be used for fuel. The rest of the hydrocarbons will be metered and returned to the utility company that operates the Devon-Edmonton pipeline. Ethylene produced by this process will be 99.85 percent pure.

After separation of ethane from the natural gas and its cracking to ethylene, the pure ethylene gas at 550 psi. will be piped to the polyethylene plant. There it will be compressed to more than 20,000 psi. by compressors of over 600 hp. each and fed into the reaction vessels.

At this pressure, in the presence of traces of oxygen and at about 200 deg. C., some ethylene will polymerize to form liquid polyethylene. This liquid polyethylene will be removed from the reactor continuously, and after being separated from any unpolymerized ethylene will be solidified by cooling and cut into cubes about $\frac{1}{8}$ in. on edge. Unconverted ethylene will be recompressed and recycled to the reactor.

Flake polyethylene of various grades and colors will be packed into 50-lb. bags and shipped to converters, who will make film, tubing, pipe, molded parts and other products from it.

Thus production of polyethylene by Canadian Industries Ltd. becomes part of Canada's unfolding petrochemical future.

Pulp makers prefer southern comfort

For the third straight year, the South's cut of pulpwood has set a record. Twelve southern states, according to the Forest Service of the U. S. Department of Agriculture, last year cut a total of 14.6 million cords of pulpwood. This was considerably more than half of the total U. S. cut of 25 million cords in 1952.

Dixie's pulpwood cut last year was nearly 4 percent larger than in 1951, and 17 percent greater than in 1950. All southern states except Virginia and Oklahoma chalked up increases. Biggest gains were in Alabama, Georgia and Louisiana.

Georgia was the South's leading producer, with 2.5 million cords. Mississippi ranked second with 1.8 million cords. Alabama and Florida were next with about 1.6 million cords each, and all other southern states except Arkansas, Tennessee and Oklahoma produced more than a million cords each.

The South probably also leads the nation in manufacturing capacity for turning the raw wood into pulp. Dixie had 63 pulp mills at the close of 1952, with a total capacity of 26,900 tons of pulp daily. Six new southern mills, with a projected capacity of over 2,300 tons daily, were under construction.

Louisiana's eight mills top the South with a total daily capacity of 4,600 tons of pulp. Florida has nine mills, with a capacity of 4,300 tons per day. Georgia ranks third and South Carolina fourth.

More and more hardwood is being used for pulp. Hardwood made up 1.7 million cords of the South's total last year, a gain of 17 percent over 1951. This trend is important because the South has an abundance of hardwood for pulping, while pine is at a premium.

Another refiner goes into petrochemicals

Entering the petrochemical business, Warren Petroleum Corp. will build a $1.5 million plant at Houston, Tex., to produce hydrocarbon derivatives.

The decision to get into petrochemicals came after Warren had thoroughly tested its improved hydrocarbon oxidation process in a pilot plant at its Tulsa, Okla., research laboratory.

In the new Houston plant, the oxidation process will convert either propane or butane, or their mixtures, into acetaldehyde, methanol and pentaerythritol. Other petrochemicals are also expected to be made.

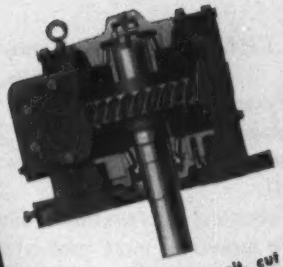
When completed in January 1954, the plant will have capacity for annual production of 2 million pounds of acetaldehyde, 4 million pounds of methanol and 2.5 million pounds of pentaerythritol. An oxygen plant will be included in the new facilities.

More para-xylene from petroleum

Hydroforming will be used to manufacture para-xylene from petroleum in a new plant now being built at the Whiting, Ind., refinery of Standard Oil of Indiana. Anticipated production, after the plant begins operation in January 1955, will be 14 million pounds per year.

An aromatic hitherto made largely from coal tar, para-xylene is made from petroleum by hydroforming,

(*Continued on page 112*)



The Cleveland ND unit, cut away to show tapered roller bearings on gear shaft, positive face-type oil seal, piston type lubricating pump and oil drain at base of housing.

At left—Cleveland size 50 ND unit on pressure mixing tank built by C. E. Howard Corporation, South Gate, Calif.

Space-saving ND unit mixes medicines smoothly

NOW at work in the production laboratories of a large drug company, this Howard pressurized, stainless steel agitator handles thousands of gallons of medicinal liquids. Smooth, efficient mixing is assured by the powerful drive—a Cleveland worm gear speed reducer mounted on the tank.

Heart of the Cleveland worm gear speed reducer is a case hardened steel worm operating on a low friction bronze gear. Materials, design and workmanship combine to provide year-after-year dependability under severest operating conditions. Easily installed on old as well as new equipment, Clevelands are known throughout the chemical and associated industries as the long-wearing reliable drive.

The ND drive shown here and its companion NU unit (drive shaft upward) are available in seven sizes each. For complete descriptions, capacity charts and other engineering data on these space-saving, powerful Clevelands, write today for free new Catalog 400. The Cleveland Worm & Gear Company, 3273 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

which converts certain petroleum fractions to a mixture of aromatics. Standard played a large part in developing the original hydroforming process just before World War II.

Polyesters for synthetic fibers and plastic film require more and more para-xylene for their manufacture.

At Whiting, the plant for separating para-xylene from the other aromatics produced by hydroforming is being engineered by Badger Manufacturing Co. Present hydroforming facilities will be used for the new operation, which will tie in with Standard's production of benzene, another important aromatic chemical once derived entirely from coal tar but now produced increasingly from petroleum.

Hydroforming was developed primarily to improve the octane number of gasoline by changing the molecular structure of the molecules present in the gasoline fractions of crude oil.

Standard engineers have recently helped to develop two improved methods of hydroforming—one the fluid hydroformer using finely divided molybdena catalyst, and the other a low-pressure fixed-bed process using an improved platinum catalyst.

Waste gas drives compressor in ammonia plant

A new high in conserving power by utilizing the pressure of waste gas will be reached in the ammonia oxidation unit that Mississippi Chemical Corp. is putting in to make nitric acid at its Yazoo City, Miss., ammonia plant. Of the 3,100 kw. required to drive the air compressor, 2,250 kw., or nearly 75 percent, will come from a turbo-expander fed with waste gas at 900 deg. F.

The rest of the power will come from an electric motor. Motor, compressor and expander will all be on the same shaft.

Brown Boveri Corp. of Switzerland is building the 6,000-rpm. compressor-expander unit. The increased cost over that of getting all power from an electric motor will be recovered in four years, according to Chemical & Industrial Corp. of Cincinnati, which is engineering the plant.

The Brown Boveri compressor is of unusual design in that it consists of nine stages all in one case, with seven intercoolers. Its predicted thermal efficiency is 5 to 6 percent higher than that of compressors of conventional U. S. design, which usually consist of two cases with a single intercooler. This increase in thermal efficiency means a saving of about 10 percent in power required for the compression job.

Plastic spheres cut evaporation losses

By substituting a layer of tiny plastic spheres filled with nitrogen for the present floating roof of steel in storage tanks, the U. S. petroleum industry could save as much as $60 million a year in crude oil evaporation losses. That's the estimate of Standard Oil Co. of Ohio.

Sohio researchers developed the microscopically small spheres, known as microballoons. They're made from a resin derived from petroleum.

Varying in size from 0.0001 to 0.003 in., the microballoons average 0.001 in. Sohio has had 10,000 lb. manufactured at a cost of 80 c. per lb.

At that cost, a microballoon roof for a storage tank 100 ft. in diameter would come to about $5,000. This represents a saving of $15,000 to $25,000 over a steel floating roof for a newly constructed tank.

Microballoons slash evaporation losses. In actual tests in Ohio, Oklahoma and Illinois, evaporation loss was cut from a former 4 bbl. per 100 bbl. to about 0.5 bbl. per 100, or a reduction of about 87.5 percent.

The microballoons can be mixed with crude oil as it is piped into a storage tank, or spread over the surface of oil in a tank. A layer about 1 in. thick seems best, according to Sohio. This plastic blanket rises and falls as oil is pumped into or out of the tank.

It took Dr. Frank Veatch and his associates, Ralph Burhans and Richard Croft, five years of intensive research in Sohio's laboratories to develop the tiny plastic spheres. Dr. E. C. Hughes directed their efforts.

Uranium jostles gold in South Africa

South Africa's new uranium industry is growing so rapidly that it may ultimately become as important to the area as gold is now.

By 1955-56 more than 10 million tons of slime residue, finely ground ore, mostly from present gold mills, will be processed annually to get out the uranium oxide. This job will be done by 11 leaching plants for 14 mining companies.

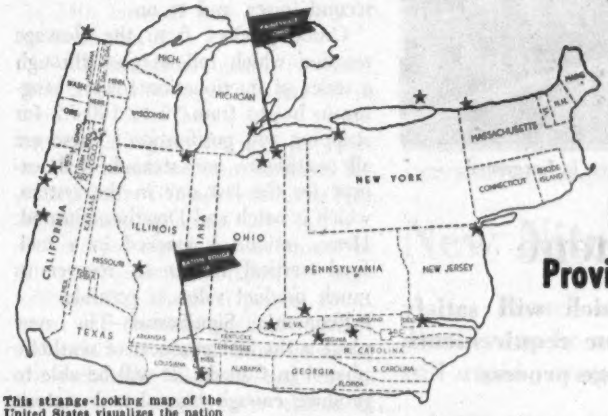
Of this 10 million tons, about 8 million will have been processed primarily for gold with uranium as a byproduct, and about 2 million will represent low-grade ore, in which the uranium may be as valuable as the gold, if not more so.

Capital cost of the present expansion in uranium production, according to Prime Minister Malan, may exceed $112 million. This most likely includes a $19.6 million loan from the Export-Import Bank for added power generating and distributing facilities and for plants to make sulfuric acid, needed in processing of uranium.

It was in 1950 that the South African Atomic Energy Board, the United States and Britain entered into an agreement calling for large-scale extraction of uranium. So far, 16 mines have been approved as producers, and others are expected to join in the venture.

What's Happening, turn to page 114

Announcing TWO MORE GENERAL CHEMICAL Sulfuric Acid Plants



This strange-looking map of the United States visualizes the nation as it might appear if the size of each state were determined by the value its manufacturing concerns add to the nation's industrial output. It is based upon the figures appearing in the 1940 and 1950 Annual Survey of Manufacturers prepared by the U. S. Department of Commerce, Bureau of the Census.

Now! America's Foremost Producer Provides Industry with 20 *Sources of Supply*

As the nation's needs for Sulfuric Acid spiral steadily upward, General Chemical again adds more plants to its network of sulfuric production facilities in this country and Canada*.

Now, large new acid facilities are going up at Baton Rouge, La., and Painesville, Ohio, to serve expanded demands in those areas. These plants are an important part of the company's continuous, long-range development program aimed at providing Industry with convenient, dependable sources of supply for this vital basic chemical.

That's why—when you deal with General Chemical—you will be served not just by one plant, but through 20. Each augments the facilities and output of the others. Together they form a coast-to-coast "pipeline" that can supply your needs equally well, whether you operate in one location or several . . . from the Great Lakes to the Gulf . . . or from Massachusetts to California.

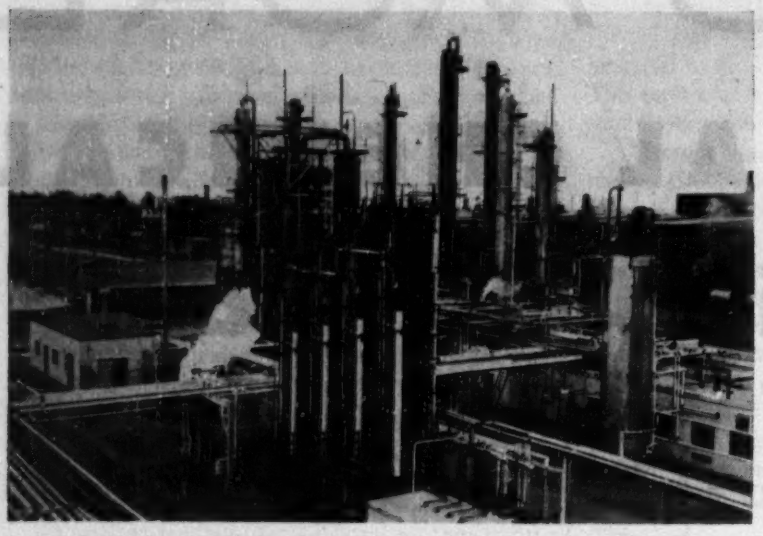
Just phone or write the nearest General Chemical office for further information on how General's Sulfuric facilities can best be put to work for you.

Allied Chemical

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
Offices in Principal Industrial Centers from Coast to Coast

*In Canada, The Nichols Chemical Company, Limited

What's Happening



OXIDATION of cumene, key process step, is done in four towers in foreground.

First Phenol From Cumene

Pioneer plant near Montreal, which will satisfy Canada's entire current phenol and acetone requirements, uses the Hercules-Distillers oxidation-cleavage process.

A new milestone in petrochemicals was passed this May with the official opening of the industry's first plant for producing phenol and acetone from petroleum-derived cumene.

B. A.-Shawinigan's $4-million unit in Montreal East, Canada, is designed to turn out annually 13 million pounds of phenol and 8 million pounds of acetone. In addition, smaller amounts of acetophenone, alpha methyl styrene and mesityl oxide will be available as byproducts.

Joint owners of the new plant are British American Oil Co. and Shawinigan Chemicals Ltd. New facilities have been installed at British-American's nearby refinery to provide the cumene supply.

▶**Defies Northern Winters**—The entire phenol plant is out in the open. While this type of construction is common in more moderate climates, its use in Canada is unusual.

Outdoor construction was dictated not by any savings in building costs but by the desire to avoid undue vapor concentrations. Its prime disadvantage is that it requires a lot of steam-tracing lines—20 miles of them.

The plant was built by M. W. Kellogg Co. Ground was broken in April 1952; less than a year later the plant was on stream on a trial basis.

▶**New Process**—B. A.-Shawinigan has been licensed by Hercules Powder Co. and Distillers Co. Ltd. to use the cumene hydroperoxide process. Cumene (isopropyl benzene, made by alkylating benzene with propylene) is oxidized with air to make cumene hydroperoxide, which is subsequently split, using sulfuric acid as catalyst, into phenol and acetone.

Details of the oxidation and cleavage steps are not available. By external appearances, however, the oxidation unit consists of four vertical towers, each about 4 ft. dia. by 30 ft. high, in a cascade arrangement (see cut). Compressed air enters the bottom of each tower; cumene enters the bottom of the first tower, overflows at the top, is piped to the bottom of the second tower, and so on.

Crude product from the cleavage reaction which follows goes through a series of fractionation towers, ranging in height from 50 to 100 ft., for stripping and purification. These are all continuous and steam-heated, except for the last one in the system, which is batch and Dowtherm-heated. Heavy residue is cracked in a fuel-fired vertical heater to recover as much product value as possible.

▶**Economic Significance**—The new plant is the first producer of synthetic phenol in Canada. It will be able to produce enough phenol and acetone to satisfy current requirements of Canadian industry.

Shawinigan is discontinuing manufacture of acetone from carbide-based acetylene at its Shawinigan Falls works, freeing this acetylene for other uses.

The phenol plant occupies five acres of a 20-acre site, leaving room for future expansion of B. A.-Shawinigan's activities.

Bigger Chemical Show Expected in Philadelphia

The Exposition of Chemical Industries, held in New York almost continuously since 1915, will move this year to Commercial Museum and Convention Hall in Philadelphia for

in Chemical Engineering

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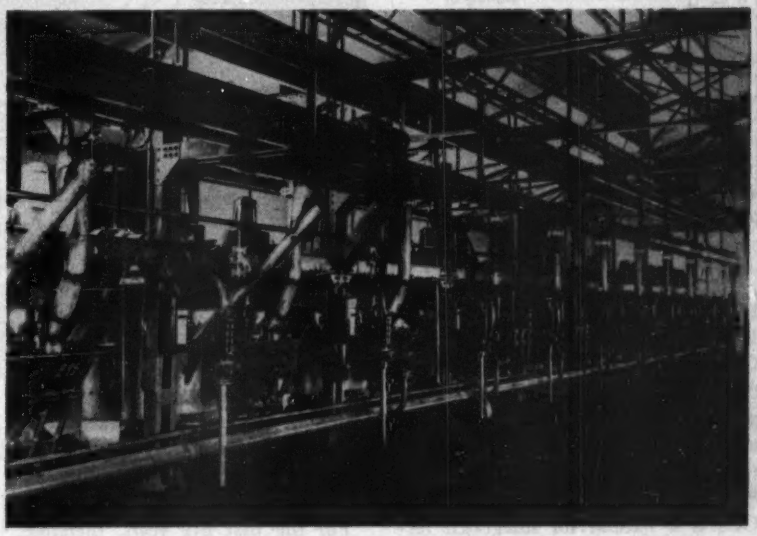
its 24th biennial run, November 30 to December 5.

With exhibit area greatly increased, it will be the largest display of its kind ever held. Many former exhibitors are taking advantage of the move to Philadelphia to plan expanded layouts. Nearly 100 new exhibitors have already engaged space.

Need for expansion was proved by the ever widening horizons for manufacturers of chemical process equipment and chemical products. Many old exhibitors needed more room for comprehensive displays, and manufacturers of entirely new classes of products were eager to exhibit. All these signs point to a better, as well as a bigger, exposition.

Commercial Museum and Convention Hall, where many industries hold expositions each year, has the advantage of an expanding highly industrialized climate. Many new visitors from industries that are increasingly aware of the impact of chemical progress are expected at this year's chemical show. Philadelphia is easily accessible from all points by air, rail and highway. Hence record attendance is anticipated.

The forthcoming exposition, like its predecessors, will be managed by the International Exposition Co. of New York. Charles F. Roth is manager, and E. K. Stevens associate manager.



CONTACTORS of special design are used to acidulate, ammoniate and stabilize.

New Nitrophosphate Process

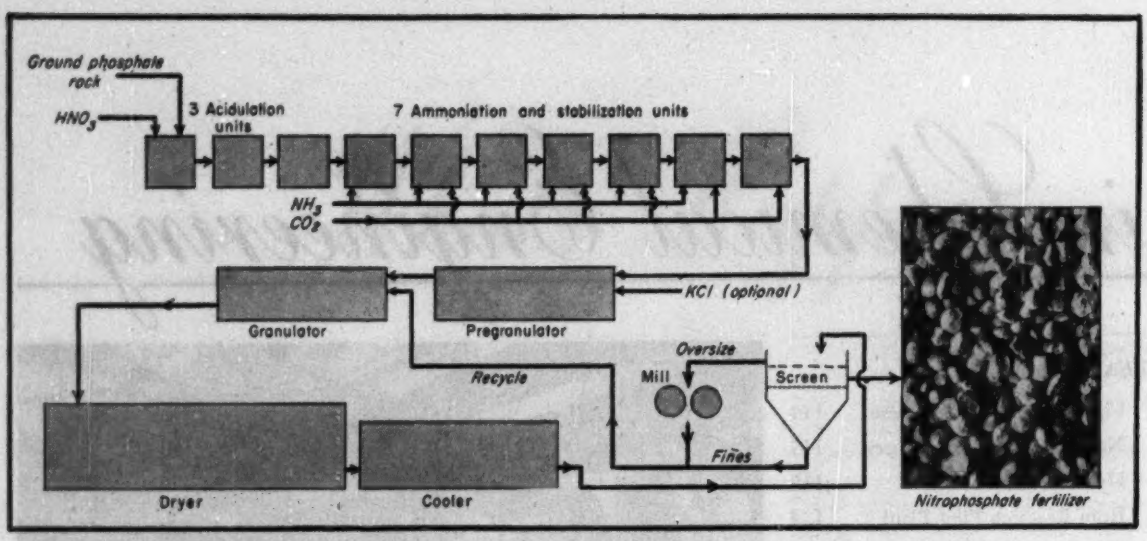
French and Germans team up to show how carbon dioxide can be used directly to stabilize calcium nitrate and still avoid reversion to insoluble phosphates.

A new process for making nitrophosphate fertilizers began commercial operation this spring in Germany on a scale of 300 metric tons per day. The plant is located at Castrop-Rauxel, near Essen, and is operated by Gewerkschaft Victor.

Significant feature of this operation is the use of carbon dioxide to convert corrosive, unstable and hygroscopic calcium nitrate into calcium carbonate. This is done without having to separate the calcium nitrate from the mixture. Other nitrophosphate processes either remove the calcium nitrate or use sulfuric acid, phosphoric acid or potassium sulfate to tie up the calcium as the sulfate or phosphate.

▶ **Secret of Success**—The new method was discovered and plant-tested on a 30-ton-per-day scale by researchers of the French firm, Potasse et Engrais Chemique. They found that by adding small quantities of certain metallic salts before ammoniation of the nitric-acidulated phosphate, the pH of the mixture could be taken to 9 or higher without reversion to citrate-insoluble phosphates. (Usually pH 3 is the limit without reversion.) The strongly alkaline ammoniated slurry can then be treated successfully with CO_2.

The mechanism by which these metallic salts work is not yet fully understood. However, it has been established that salts containing magnesium and aluminum are the most effective. For example, with one particular fertilizer composition 6 lb. of magnesium or aluminum per ton of product is quite sufficient.



FLOWSHEET of typical nitrophosphate fertilizer plant using CO_2 for stabilization. Product (right) runs 2 to 4 mm.

Licensing of this process—and other PEC fertilizer developments—is being handled in the United States by Chemical & Industrial Corp., Cincinnati. The first U. S. plant is expected to go on-stream next year. Several other potential customers are said to be showing strong interest.

▶**Ammonia Tie-In**—Stabilization with CO_2 is a natural for integrated fertilizer plants making their own ammonia—the CO_2 is available as a waste product from the ammonia operations. PEC's own nitrophosphate plant at Grand-Couronne, near Rouen, now using H_2SO_4 or H_3PO_4 for stabilization, is contemplating changing over to CO_2 if suitable arrangements can be made to bring in CO_2 by pipeline.

Attractive feature of the CO_2 process, as far as the product itself is concerned, is the wide range of fertilizer compositions which can be made. There is no minimum ratio of nitrogen to phosphorus which must be maintained.

▶**Uses Straight Nitric**—PEC first undertook small-scale production of nitrophosphate fertilizers in 1942 while under German occupation. Commercial operations really got started after the liberation in 1945, at a rate of 200 metric tons per day, growing to the present scale of 500 tons.

Until 1948, the plant used a mixture of nitric plus sulfuric acids for acidulation of phosphate rock. This led to trouble from two sources:

• Equipment corrosion was very severe; the stainless steel used for nitric acid resistance didn't stand up well with sulfuric present.

• The acidulated slurry contained nitrous gas which, upon ammoniation, formed ammonium nitrite. This material, subject to spontaneous decomposition, was a serious hazard, until PEC developed special equipment designed to remove these gases.

For the past five years, therefore, PEC has acidulated with nitric acid alone, eliminating both these problems, at the same time increasing the over-all nitrogen yield. The new German plant also uses straight nitric acidulation, since PEC is convinced that the nitrous gases cannot be removed when using mixed acids.

▶**Continuous Process**—Sequence of operations is acidulation, ammoniation and stabilization, granulation, drying and screening. Desired product particle size is in the range of 2 to 4 mm. Fines are returned to the granulator; oversize is ground and recycled.

Acidulation, ammoniation and stabilization are carried out continuously in a line of contactors (*see cut*). These contactors, developed over a period of years by PEC, provide vigorous agitation and controlled mixing.

Details of construction haven't been revealed; all that can be reported is that each of the units has several agitator shafts. The special design avoids the formation of foam, it is claimed, even with uncalcined phosphate rock. According to PEC, the rock need be ground no smaller than 20 mesh.

A 300-ton-per-day plant uses some of these units for acidulation, others for stabilization and ammoniation.

When operating with CO_2 stabilization, NH_3 alone is injected first to raise the pH. Then both NH_3 and CO_2 are added to each of the rest, except for the last—here CO_2 alone is used.

▶**Simple, Compact**—Initial capital investment is said to be low. A 200-ton-per-day plant requires only 13 tons of stainless steel, occupies an area 70 ft. by 120 ft. Unless there is some reason for wanting to remove ammonium nitrate from the product, there is no need for any filters or evaporators.

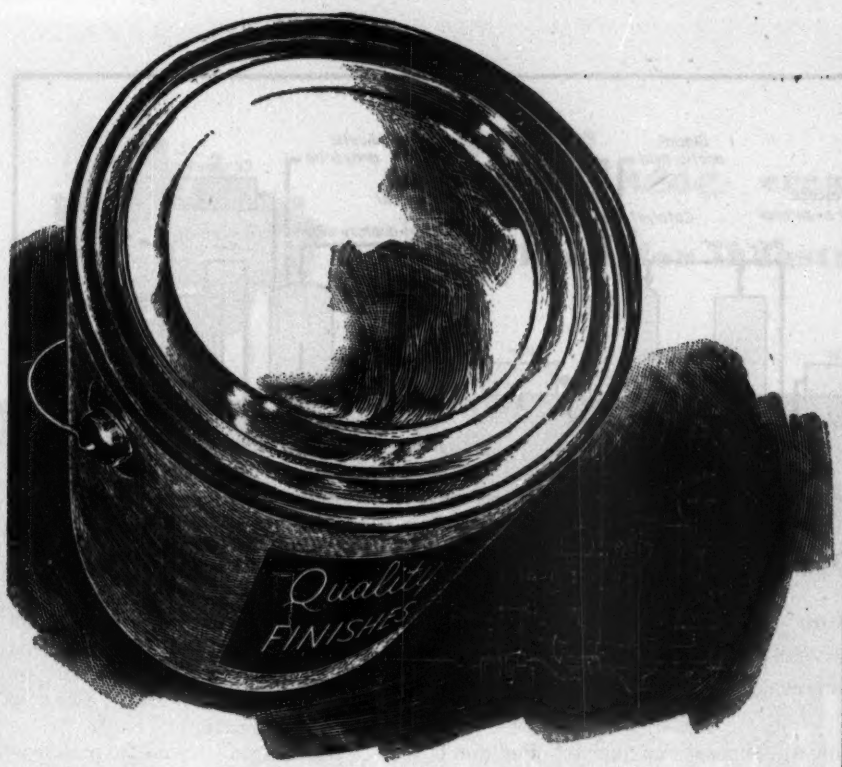
Per ton of product, plant operation requires 0.7 man-hr. labor, 38 kwh. electricity, 8 gal. Bunker C fuel oil.

The same plant can operate with CO_2 stabilization or with any of the other process variations, such as stabilization with H_2SO_4, H_3PO_4 or potassium sulfate. This provides a wide flexibility in choice of raw materials and product composition.

Milk Prices Blamed As Casein Production Ends

Hercules Powder Co. has discontinued production and sale of acid and rennet casein. Its casein plants in Elroy, Wis., Cambridge, Minn., and Watertown, Minn., will be closed.

Milk prices have made it economically impossible, according to Hercules, to manufacture casein at costs that make possible its sale in competition with imported casein.



Today's Paints... Science's "Synthetic" Achievement!

Down through the centuries, paints of various types have proved man's most effective means of protecting his handiwork against the ravages of time and nature.

The fact that today's finishes are able to keep pace with modern production techniques is due in large part to the substitution of chemically synthesized resins and pigments for the fossil gums and natural colors upon which the paint maker was once forced to rely.

RCI, the world's largest manufacturer of synthetic resins and a major producer of chemical pigment colors, congratulates the paint industry on the skill with which it has employed these ingredients in bringing about the innumerable improvements achieved in surface coating materials during the past thirty years.

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Uses of RCI Products

CANVAS, PAPER AND GLASS CLOTH LAMINATES: PLYOPHEN cresol, phenolic and resorcinol-formaldehyde resins and varnishes; RCI polyester resins.

CARBON PAPER: RCI inorganic chemical pigment colors.

CASTINGS: FOUNDREZ powdered phenolic resins (for the shell molding process); FOUNDREZ liquid phenolic resins and FOUNDREZ core oils (for core binders).

FURNITURE, PLYWOOD, FLOORING, HARDBOARD AND CHIPBOARD: HYDROPHEN phenolic glues; PLYACIEN protein glues; PLYAMINE urea-formaldehyde glues; PLYOPHEN phenolic and resorcinol-formaldehyde glues.

LEATHER: BECKOSOL alkyd resins (for leather finishes); PLYOPHEN resorcinol-formaldehyde resins, SUPER-BECKACITE pure phenolic resins, SYNTHE-COPAL ester gums (for leather adhesives).

LINOLEUM: BECKOSOL alkyd resins and PENTACITE pentaerythritol resins (for linoleum coatings); RCI inorganic chemical pigment colors.

PAINTS, VARNISHES AND LACQUERS: BECKACITE (1) fumaric, (2) maleic and (3) modified phenolic resins; BECKAMINE urea-formaldehyde resins; BECKOLIN synthetic oils; BECKOPOL modified phenolic resins; BECKOSOL (1) phenolated, (2) phthalic-free, (3) rosin modified, (4) pure drying and (5) pure non-drying alkyd resins; KOPOL processed Congo copals; PENTACITE pentaerythritol resins; STYRESOL styrenated alkyd resins; SUPER-BECKACITE pure phenolic resins; SYNTHE-COPAL ester gums; WALLKYD pure drying alkyd resins (for alkyd flat wall vehicles); WALLPOL vinyl-type copolymer latex emulsions (for latex flat wall coatings); RCI inorganic chemical pigment colors.

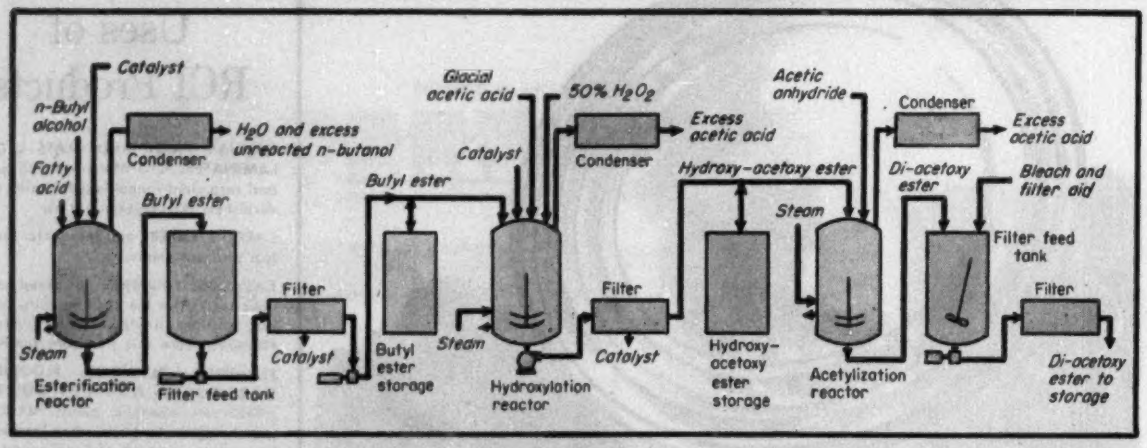
PAPER: BECKAMINE urea-formaldehyde resins (for adding wet strength, improving the wet rub of starch-clay coatings, and waterproofing starch adhesives); RCI inorganic chemical pigment colors (for paper coloring); STYRESOL styrenated alkyd resins (for paper coating).

PRINTING INKS: BECKACITE fumaric, maleic and modified phenolic resins; BECKOLIN synthetic oils; BECKOPOL modified phenolic resins; RCI inorganic chemical pigment colors.

TYPEWRITER RIBBONS: RCI inorganic chemical pigment colors.

WAXES AND POLISHES: BECKACITE modified maleic resins; SUPER-BECKACITE pure phenolic resins; SYNTHE-COPAL ester gums.

RCI



Hydroxylation: New Unit Process

Peracetic oxidation turns abundant fats and oils into vinyl plasticizers, greases, other products. Here's how it is used to make plasticizers.

Hydroxylation and epoxidation are fast emerging as important processes for converting vegetable oils and animal fats into vinyl plasticizers and other new products. Using this new method, Baker Castor Oil Co. has recently become the first commercial producer of a synthetic hydroxlated fat.

For Baker, with its 93 years of experience in production and marketing of castor oil, the only commercially important hydroxylated natural oil, the move into the new synthetics was a natural.

Currently, Baker is swinging into larger volume output of its first pair of these products, one a butyl hydroxy-acetoxy ester, the other a butyl polyacetoxy ester. Both are low-cost secondary vinyl plasticizers. They can also be used as primary plasticizers for synthetic rubbers and cellulosic resins.

In essence, the process consists of the oxidation of fats or oils with peracetic acid to yield epoxidized, hydroxylated and acetylated products. It was developed by the Eastern Regional Research Laboratory of the U. S. Department of Agriculture.

Reaction temperature largely determines the kind of products; lower temperature favors epoxidation. The peracetic acid is made from acetic acid and hydrogen peroxide.

▶**Broad Impact**—What will be the impact of the new hydroxylation and epoxidation process? For the U. S. Department of Agriculture, it comes as the capstone of long research to find profitable outlets for the mounting surplus of inedible hog and cattle fats. Harassed soapers and processors of fats are increasingly plagued by this surplus caused by the inroads of synthetic detergents.

For Baker, it means diversification in chemicals and greater flexibility—a producer can shift to different fatty acid sources as fats and oils prices fluctuate. Cheap and abundant raw materials, such as soybean oil, animal fats and even fish oils, can be tapped. The process works equally well on acids, esters or glycerides.

For plastics manufacturers, it means soft, flexible vinyl sheet and film even at low temperatures.

For alert researchers, hydroxylation and epoxidation open new realms. The peracetic process isn't limited to plasticizer production. It can be used in the manufacture of epoxy resins and in the synthesis of cortisone, where it helps to introduce an oxygen in the C_{11} position.

Baker, overlooking no possibilities, is already eyeing the tempting market in greases, has started semi-commercial production of synthetic hydroxystearic acids. Other possibilities abound. Among them: lubricating oils, cutting oils, textile oils, synthetic waxes, improved drying oils, cosmetic ingredients and unusual metallic soaps.

▶**Genesis of a Process**—Pioneer research at the Eastern Regional Research Laboratory near Philadelphia resulted in the development by Waldo C. Ault and Daniel Swern of USDA's peracetic process.

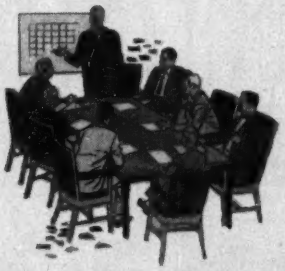
Baker began work on the process in 1949. This effort was intensified in 1951, when Don S. Bolley, technical director, stepped up work on a modification of the USDA process, and M. Kent Smith, who directs commercial chemical development, accelerated investigation of uses for the new hydroxylated products. Pilot-plant production in a 20-gal. unit began in January 1953, and limited operation at a commercial level in April.

▶**How Baker Does It**—At its Bayonne, N. J., plant, where it is now turning out hydroxylated and acetylated products at an increasing tempo, Baker has facilities to produce more than 5 million pounds per year of synthetic hydroxylated fats. Having its own esterifying and acetylating units gave Baker an advantage, since it had only to install a hydroxylation reactor.

Baker has modified the ERRL patented process by changing temperatures and other operating conditions. The process is batch now, but can easily be switched to continuous when the market warrants. Here's how Baker's modified process works:

Raw materials can be soybean oil or other vegetable oils, animal fats, mixed acids from these fats and oils, or pure fatty acids such as oleic. Hydrogen peroxide for the process comes from Du Pont or Buffalo Electro-Chemical Co.

▶**Esterification**—First step in making



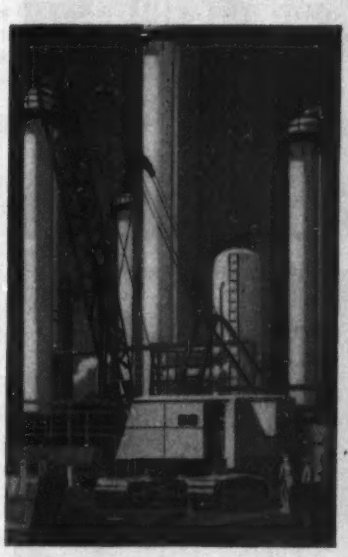
Celanese creates new horizons for industrial chemistry

The rapid rise of Celanese Corporation of America from an obscure beginning to its current unique position, typifies the success saga of American business. In more than a casual sense, the Celanese story is that of the world's chemical plastics and textile industries. As a result of its infinite drive for perfection, the American people of every economic level are better dressed than any other nation of the world.

Celanese Corporation's integration program embraces affiliates in Europe, the Orient, Latin America, and extensive expansion of already vast operations in Canada and the United States.

On the domestic front, Celanese is enlarging its scope in the production of raw materials for the chemical, plastics and petrochemical fields, and developing fibers to put new emphasis on industrial synthetics.

Brown & Root feels signally honored to have been selected to design, engineer, and construct plants in three different nations, for Celanese Corporation of America. This is another example of the greatest names in American industry benefiting from Brown & Root's extensive experience in process engineering and construction.



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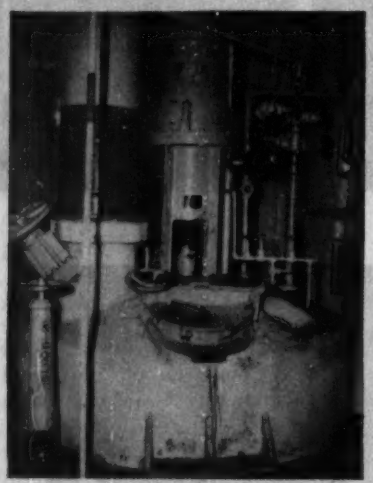
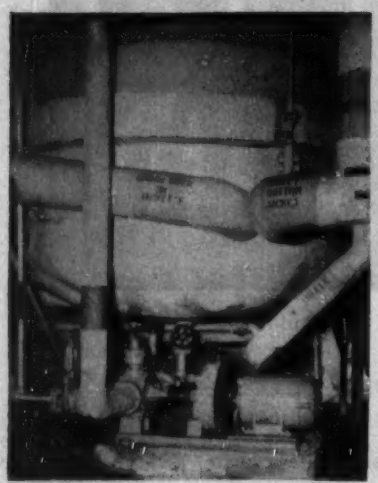
Baker's new vinyl plasticizers is a straightforward esterification carried on in a bank of three 1,000-gal. Everdur reactors. Sulfuric acid catalyzes the esterification, which is run at the reflux temperature of the alcohol. Pure fatty acids and mixed acids can be esterified, as can oils by alcoholysis. Currently, Baker is making methyl, butyl and isobutyl esters.

After esterification, excess alcohol is distilled off, and the ester filtered with activated carbon and diatomaceous earth to remove sludge. It is important to get rid of solids since they would decompose the peracetic later during hydroxylation.

▶**Hydroxylation**—Nub of the process, of course, is the hydroxylation. It's done in a 1,000-gal. stainless reactor. A specially modified alkyd kettle, the reactor is equipped for heating or cooling by Dowtherm. Since lead and copper might form explosive peroxides when in contact with peracetic acid, brass thermocouple wells had to be pulled out and replaced.





REACTOR where ester is hydroxylated.

The entire system is totally inclosed and vented. The jacketed kettle has an anchor agitator with extra arms. Some esters or fatty acids are not completely soluble at the start, and with an immiscible mixture agitation is important.

Extreme care is required in readying the hydroxylation reactor. First, it's washed with caustic to get out oil, then flushed down with water. Next, it's pickled with acetic to prevent decomposition of peracetic, and finally it is cleaned with a mild soap solution.

There are many ways to carry out the hydroxylation with peracetic acid. Baker makes the peracetic first.

Mineral acid catalyst is dissolved in glacial acetic. Then 50 percent hydrogen peroxide is added to the acid in the reactor. The solution is heated to at least 40 deg. C. to get efficient formation of peracetic acid.

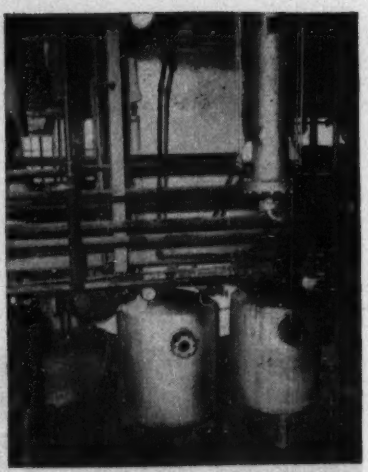
When maximum peracetic formation is reached, controlled addition of the fatty ester begins. The hydroxylation and epoxidation reactions are exothermic; liquid Dowtherm is used for cooling. An efficient cooling system is essential for flexible production of epoxy or hydroxy products. The epoxys are made at a lower temperature.

The liquid surface foams lightly during hydroxylation. The reaction takes place at atmospheric pressure and at temperatures ranging from 50 to 80 deg. C., depending on the product. Ester is added as fast as the cooling system can absorb the heat of reaction. It takes less than 2 hr. to complete a typical run. Esters, acids or glycerides can be hydroxylated or epoxidized directly. Simultaneously, of course, some acetylation occurs.

Excess acetic is distilled off, and the product from the reactor is run through a closed aluminum pressure filter to take out acidic catalyst sludge. The filter has to be closed to handle warm acetic.

Color stays pretty much the same during hydroxylation or occasionally even gets lighter.

At this point, Baker recovers one of its new products, the butyl hydroxy-acetoxy ester, dubbed Estanox 203. To make the other, an additional acetylation is required.



ACETYLATION takes place here.

▶**Acetylation**—This extra step is done in a bank of three 1,000-gal. aluminum stills. Hydroxy-acetoxy ester is acetylated with acetic anhydride at a liquid temperature of 130-140 deg. C.

As acetic acid distills off, unreacted anhydride concentrates. Finally, remaining unreacted anhydride is distilled off. This is done under a vacuum of 15 in. Hg for convenience and safety.

When acetylation is complete, by-product acetic acid and anhydride are distilled off. The ester is then deodorized to rid it of any sour acetic smell. It is filtered through an aluminum plate-and-frame press. Two percent of treated clay and 0.5 percent of activated carbon are added.

This completes the manufacture of the other new product, Estanox 206, a butyl poly-acetoxy ester. The dihydroxystearic and polyhydroxystearic acids that Baker is now making semi-commercially are made from oleic by direct hydroxylation.

▶**Vinyl Market Ripe**—How big a market in vinyl resins will there be for these hydroxylated and epoxidized fatty plasticizers? With the total demand for vinyl plasticizers now running in the neighborhood of 150 million pounds a year, they might reach 25 million pounds each year. As secondary plasticizers, they reduce the volume of dioctyl phthalate required. Thus 1 part of Estanox 206 can be blended with 2 parts of DOP. This holds down the total cost of the plasticizer blend, according to Baker. In a typical formulation, about 40 parts of plasticizer are used with 60 parts of resin.

(Continued)

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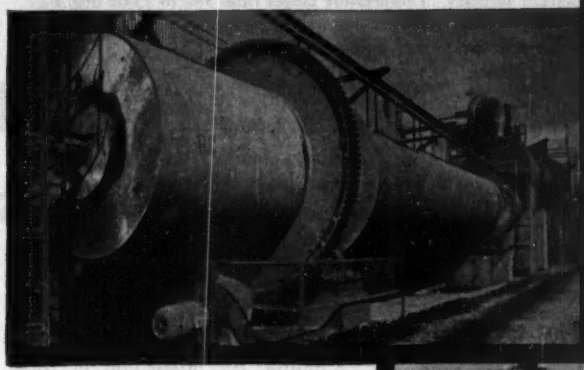

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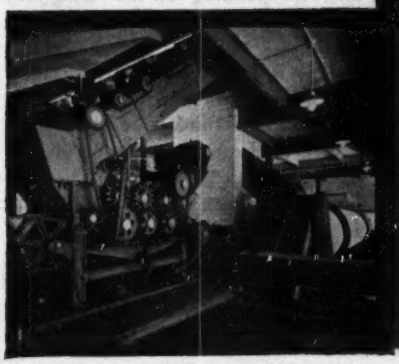

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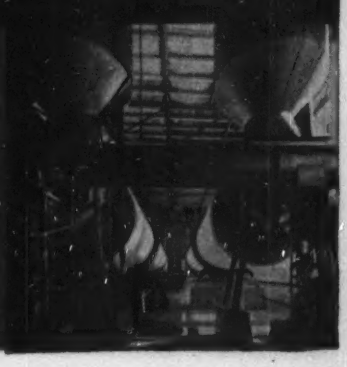
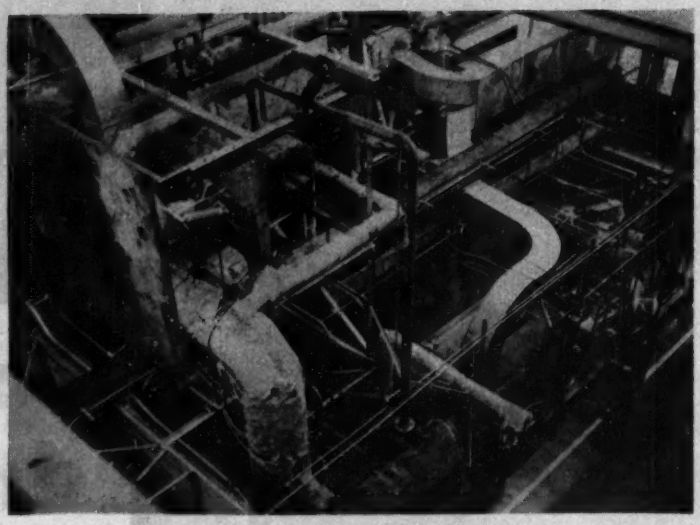


Fully acetylated derivatives, Baker is confident, have added advantages. Not only do they impart greater flexibility to vinyl film, but they are more compatible. When acetylation converts a hydroxy group to an acetoxy group, the ester becomes more compatible and more of it can be milled into the vinyl resin.

▶**Future for Fatty Acids**—For hydroxylated fatty acids, an important market will be multi-purpose greases. If prices can be held down close to that of monohydroxystearic, this market in greases could reach 10 million pounds per year, and it will go even higher when lithium becomes more abundant. Hydroxylated fatty acids will fit nicely into this new market in greases.

What inroads the new peracetic process will make on the growing annual surplus of inedible animal fats remains to be seen. Undoubtedly it will take some of this hog and cattle tallow, but how much will depend on the price pattern for fats and oils from all sources.

Off to a spanking start with its first synthetic hydroxylated fats, Baker is certain that for hydroxylation and epoxidation processes this is but a beginning.



LIQUID SODIUM FOR NUCLEAR REACTORS

Liquid sodium is pumped and metered electromagnetically in this experimental closed circuit loop at the Knolls Atomic Power Laboratory in Schenectady, N. Y., operated by General Electric Co. for AEC. Magnetic meter measures flow in gpm. within 2 percent accuracy. Temperature ranges from 580 to 1,000 deg. F., and pressure from 0 to 75 delta pressure. Pump and flowmeter have no moving parts. General Electric now makes both commercially.

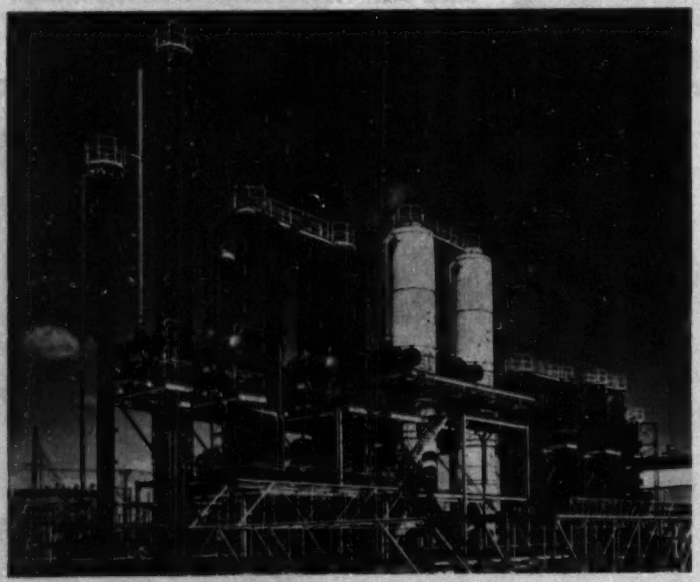
Solvay to Make Organics By Chlorinating Methane

Chlorinated methane products will be made by the Solvay Process Division of Allied Chemical & Dye Corp. in a new plant to be built near Moundsville, W. Va.

The plant will cost more than $2 million. It will take about 10 months to build.

Breaking into chlorinated organics, Solvay will produce methylene chloride, methyl chloride, chloroform and carbon tetrachloride.

Chlorine for production of these chlorinated derivatives of methane will come from Solvay's large chlorine-caustic plant now being completed on the Ohio River just south of Moundsville.



NEW VINYLTOLUENE PLANT FOR DOW

In this new plant at Midland, Mich., now rapidly nearing completion, Dow Chemical Co. will be producing vinyltoluene in volume by early next year. Vinyltoluene can replace styrene in resins and synthetic rubber, but its biggest future market will come in paint vehicles. Unlike styrene, it reacts with all commercial drying oils to form vehicles for improved paints.

Cat Polymerizer Added As Texas Refiner Expands

A new catalytic polymerization unit is operating at the Longview, Tex., refinery of Premier Oil Refining Co.

This is the second polymerization unit used by Premier in its refining operations. A third is being installed as part of Premier's expansion at Fort Worth.

Cost of the new cat polymerizer at Longview, plus replacement and rehabilitation of other equipment, exceeded $250,000. It is a part of the current $2 million expansion now under way at Premier's refineries.

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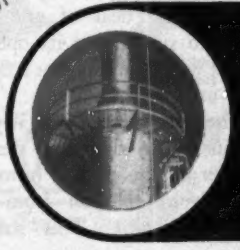

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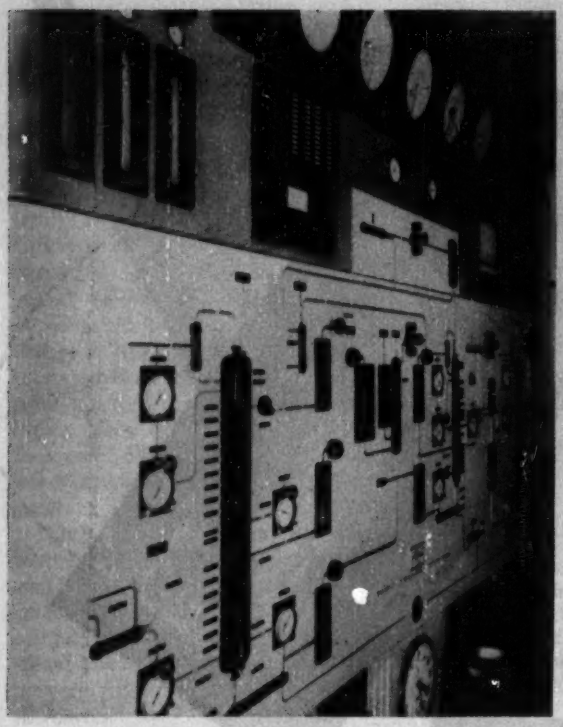
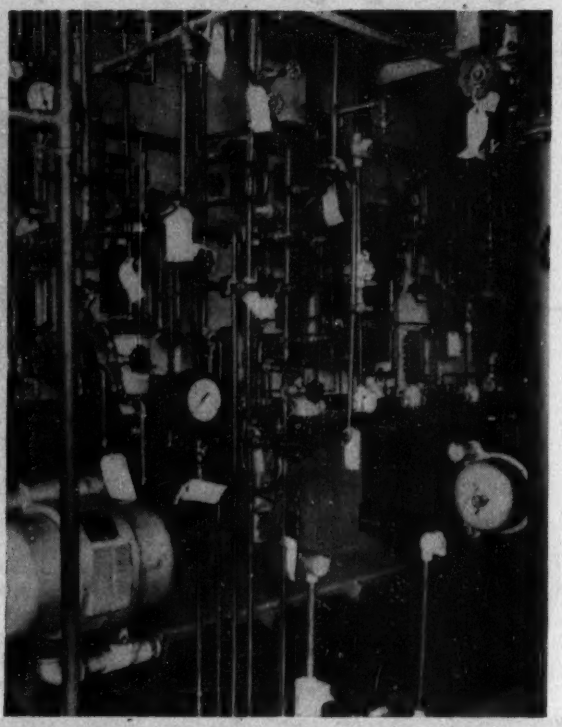


FRONT of control panel features ease of operation.



REAR indicates complexity of the distillation control.

Pilot Plant for Rum Research

Uses centralized automatic control on a distillation system operated at low flow rates. Graphic panel flowsheet is in color.

What makes Puerto Rican rum a favorite throughout the world? Up to now nobody has been able to say precisely, not even the Puerto Ricans.

This situation is due to change very shortly. Officially opened with appropriate ceremonies in March was a $500,000 pilot plant at the University of Puerto Rico for studying the fermentation and distillation of rum. It was financed by the Puerto Rican government and engineered by Arthur D. Little, Inc., Cambridge, Mass.

▶**A Top Earner**–Rum is a $50-million-a-year business for Puerto Rico–second largest of the island. (During a recent four-year period total rum revenues and taxes to the Puerto Rican government amounted to almost $215 million.) That's why the government wants to reduce its production to a science. Specifically the pilot plant's purpose is to (1) study the taste and flavor qualities of Puerto Rican rum; and (2) experiment to find the best possible fermentation, distillation and blending practices for its production. The government intends to pass this information on to the individual distillers–an industry technical-education program. Victor Rodriguez-Benitez is Technical Director of the pilot plant; W. V. Keary was the project engineer for A. D. Little and S. N. Fox, assistant project engineer.

▶**What's New**–Special features of this plant are: (1) the fermentation equipment, allowing use of new continuous processes as well as established batch techniques; and (2) a distillation unit with flexibility of operation and continuous measurement and control of all process variables.

The distillation unit provides the three standard steps of distilling alcohol:

Separation of the alcoholic liquor from the mash (beer column); stripping of the low-boiling impurities (purifying column); and distillation of high-purity beverage alcohol (rectifying column).

Major problems in the design were the small scale of operations coupled with continuous control of all process variables. For proper integration with the fermentation equipment, a feed of approximately 1 gpm. of molasses mash was chosen and all production units sized accordingly. But this would have resulted in stripping and rectification equipment too small to be practical. So the beer is accumulated and the last two steps are run on a continuous basis when sufficient feed is on hand.

Similarly, a separate fusel oil (higher alcohols) column was found to be unnecessary, and fusel oil is accumulated and purified as a separate operation in the purifying column. This unit is, of course, highly complex, and a great deal of attention was given to simplifying its operation so that it would be useful as a demonstration unit.

The beer column is a 30-plate unit 12 inches in diameter, designed to recover all the alcohol from a 5 percent (vol.) solution from the fermentation unit. This stripping is

READY FOR **RUGGED DUTY**

Maxi-Power Drive assembly for overseas cement mill. This unit, on a special base, has long input and output shafts supported by outboard bearings. The large spur pinion will drive a 20-foot, 18-inch face spur gear.

FOOTE BROS. MAXI-POWER DRIVES

With maximum load-carrying capacity for day-after-day service, Foote Bros. Maxi-Power Drives offer a ready solution for toughest speed reduction applications.

Sturdy, compact Maxi-Power Drives have precision-generated helical gearing — uniform load distribution across the entire tooth surface. Maximum performance is assured for all applications where rugged service is required.

These parallel shaft speed reducers are available in single, double or triple reductions. Ratios range up to 360 to 1 — capacities up to 1,550 horsepower — ideal for slow-speed requirements.

Foote Bros. also offers a complete line of foot or flange mounted drives for both horizontal and vertical applications, and Foote Bros.-Louis Allis Gearmotors, horizontal and vertical.

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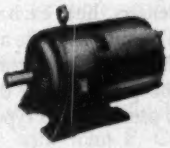

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The HYDROPEL (top half) part of this block absorbed little of the salt solution in which it was placed until all had evaporated. Air entrained concrete (lower half) sucked up the solution, leaving salt crystals throughout.

HYDROPEL is resistant to chemicals. Subjected to every known test for endurance, HYDROPEL concrete lasts longer because it resists moisture, impact, and chemicals (except acids).

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done in the 25 plates below the feed; liquor essentially alcohol-free is discharged from the base of the column. Sieve plates are used in this section to avoid accumulation of suspended solids.

Dilute alcohol from the top of the beer column is fed to a 40-bubble-plate purifying column (8 in. diameter) where low-boiling aldehydes and esters are removed as distillate. Finished product comes off near the top of the 15-in. diameter by 50-bubble-plate rectifying column.

Additional volatile impurities must be removed from the top of the rectifying column, since the original materials are not removed entirely in the purifying column and since more form with continued distillation. Fusel-oil streams withdrawn from the center of both the purifying and rectifying columns are accumulated, and from time to time concentrated in a separate operation in the purifying column. They are then water-washed in a short packed column for recovery of dissolved ethanol.

▶**Color Panel**—To give the unit pushbutton utility, ADL engineers specified a graphic panel—a simplified flowsheet of the distillation reproduced in color on the panel. The colors distinguish process units from the different types of process and utility lines.

Instruments to indicate process variables are incorporated at points on the control panel which correspond to the points of measurement in the plant. Two kinds of flow-rate instruments are used—orifice meters where the flow is adequate and rotameters with manual control valves where flow rates are too small for practical automatic control.

Items shown on the graphic panel (see cut) include the three fractionation columns, the fusel oil (bad liquor) extraction column, all condensers, heat exchangers, and pumps. The various units are connected to indicate the piping actually installed in the plant, and a different color code is used for each type of pipe.

Acquiring Thurston Adds to Grace's Fertilizer Stake

W. R. Grace & Co. will acquire Thurston Chemical Co. A manufacturer and distributor of superphosphate fertilizers and mixed commer-

cial fertilizers, Thurston has plants in Atlas, Mo., Trenton, Mo., West Tulsa, Okla., and Lawrence, Kan.

President William R. Thurston of the newly acquired company will become president and director of Naco Fertilizer Co. of West Virginia, a wholly-owned subsidiary of W. R. Grace & Co. Naco manufactures mixed fertilizers, sulfuric acid, superphosphates and concentrates. It also blends insecticides. Naco operates plants in North Carolina, South Carolina, Florida and Ohio.

This appointment, when approved by stockholders of Thurston Chemical, will bring under Thurston's direction the activities of Naco. That concern's headquarters, presently in New York, will be moved to Joplin, Mo.

Maas and Naugatuck Set Pace in Plant Safety

Two chemical companies achieving the greatest improvement in plant safety over five years have won this year's Lammot du Pont Safety Plaque Awards, presented annually by the Manufacturing Chemists' Association. The winners: A. R. Maas Division of Victor Chemical Works, South Gate, Calif., and Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn.

Naugatuck was winner among chemical manufacturers with more than two million man-hours of exposure. Its two Connecticut plants operated throughout 1952 without a lost-time accident.

The A. R. Maas Division of Victor had the best record among firms with less than two million man-hours of exposure.

Runners-up in the two divisions respectively were Tar Products Division, Koppers Co., and Jefferson Chemical Co.

In addition, the MCA awarded certificates of achievement to 178 plants of 23 chemical companies that operated without a lost-time accident during 1952.

The plaques, cast in bronze, were presented at the 81st annual meeting of the MCA at White Sulphur Springs, W. Va., with John P. Coe, vice president and general manager, accepting for Naugatuck and Raymond L. Geiler, division president, for Maas.

Established in 1951, the awards are given annually to a chemical firm in each of the two size categories. The

in Philadelphia
for the first time

more space all on one floor
more exhibitors nearly 500
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New Ideas Methods Processes Materials
Equipment Techniques Development

Chemists and chemical engineers will find an unequalled opportunity to get first hand information from the men and companies who have contributed to the advances in the fast moving chemical industries. Years of chemical processing knowledge will be conveniently assembled under one roof in this greatly enlarged exposition. The progressive exhibitors represented will have technically staffed displays designed to make this exposition more informative than ever.

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COMMERCIAL MUSEUM
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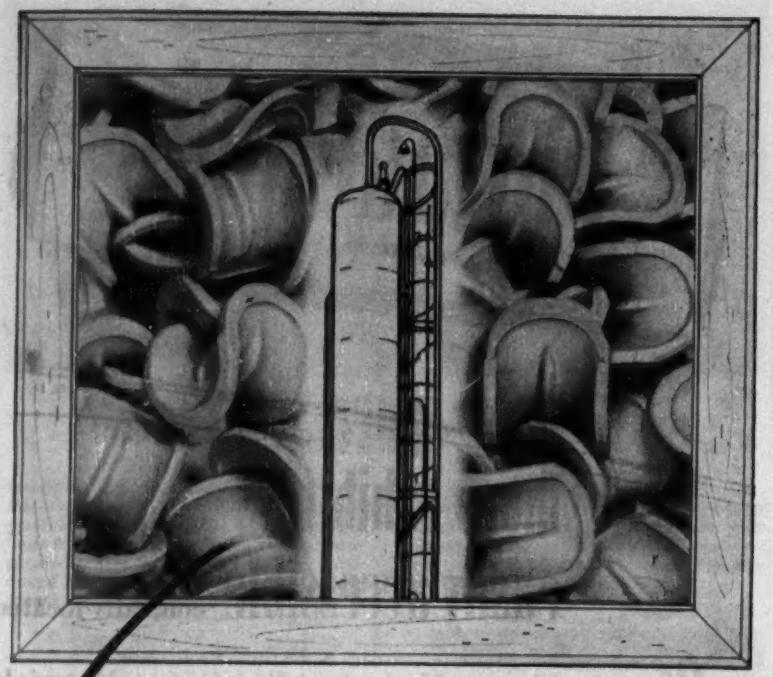

When tower efficiency must be increased,

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belong in the picture!

When the problem is how to increase tower efficiency in present or new equipment, that's when Berl Saddles enter the picture.

REASON:

Berl Saddles are a more efficient tower packing than raschig rings, spiral rings or partition rings. They offer greater surface area, lower resistance to gas flow, lower pressure drop, higher flow capacities, greater free space and better internal distribution. They are entirely acid proof, have a high crushing strength and will not spall.

Berl Saddles are available in both Knight-Ware Chemical Stoneware and porcelain. Both are dense but unglazed to provide better wetting. When desired porous packing can be made of either material.

Berl Saddles are available in sizes: ¼", ½", ¾", 1", 1½", 2".

Write for data sheet No. 13-G Knight-Ware Tower Packings.

Maurice A. Knight 108 Kelly Ave., Akron 6, Ohio

Acid and Alkali-proof Chemical Equipment

safety awards are financed by a gift to MCA from the late Lammot du Pont, former Du Pont board chairman and also a former MCA chairman.

"The chemical industry," declared William H. Ward, chairman of MCA, in disclosing the winners, "is one of the safest places to work in the world."

For 1952 the average accident frequency rate for MCA companies was 4.10, compared with 9.06 for all U. S. industry. For the first quarter of 1953, MCA companies scored a further improvement with a rate of 3.47. Rates are in terms of lost-time accidents per million man-hours worked.

CONVENTION CALENDAR

American Pharmaceutical Association, Salt Lake City, August 16-22.

American Chemical Society, fall meeting, Conrad Hilton Hotel, Chicago, September 6-11.

American Institute of Chemicals Engineers, Fairmont and Mark Hopkins Hotels, San Francisco, September 13-16.

National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, September 16-18.

American Association of Textile Chemists & Colorists, annual meeting, Conrad Hilton Hotel, Chicago, September 17-19.

American Coke & Coal Chemicals Institute, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., October 12-13.

Salesmen's Association of the American Chemical Industry, chemical sales clinic, Commodore Hotel, New York, October 19-20.

National Paint, Varnish & Lacquer Association, annual meeting, Chalfonte-Haddon Hall, Atlantic City, October 26-28.

Association of Consulting Chemists & Chemical Engineers, annual meeting, Belmont Plaza Hotel, New York, October 27.

American Petroleum Institute, annual meeting, Conrad Hilton Hotel and Palmer House, Chicago, November 9-12.

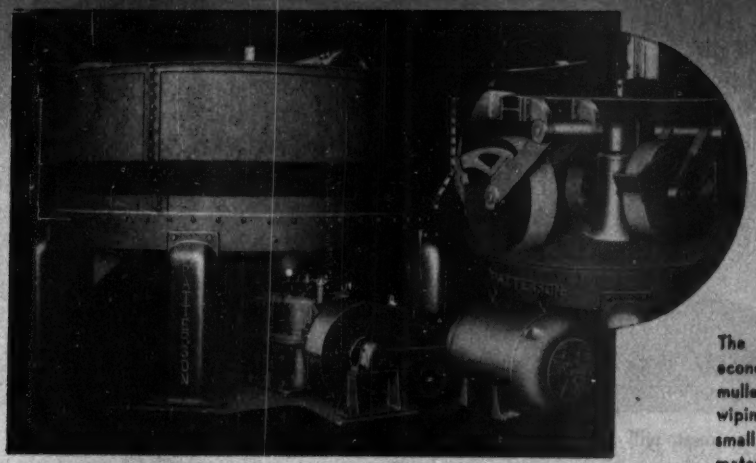
24th Exposition of Chemical Industries, Commercial Museum, Philadelphia, November 30-December 5.

American Institute of Chemical Engineers, annual meeting, Jefferson Hotel, St. Louis, Mo., December 13-16.

AGGLOMERATION—

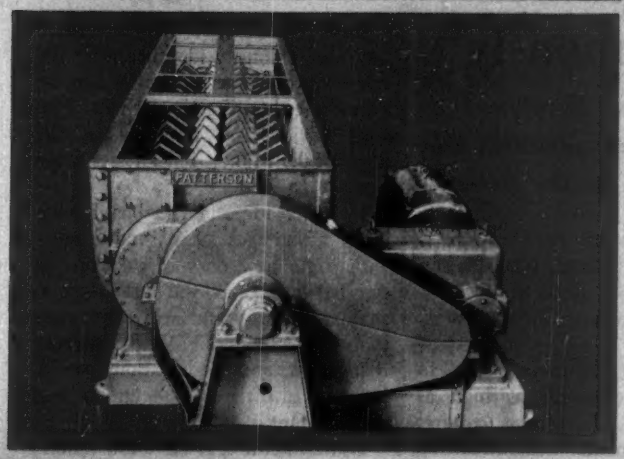
MEANS Patterson

- FOR MODERN EQUIPMENT DESIGN!
- FOR BEST EQUIPMENT PERFORMANCE!



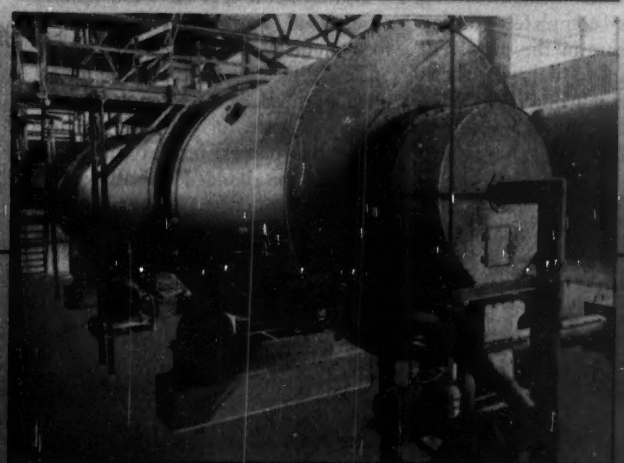
MULLING MIXERS

The Patterson Mulling Mixer is the primary unit for economical agglomerating. Equipped with wide-face mullers, it develops a highly effective kneading-smearing-wiping action. This unit is ideal for incorporating a small percentage of liquid in a large amount of dry material. As a plasticizing muller, it develops the working properties of the batch to fullest extent for subsequent forming.



TYPE GPM MIXERS
PROCESSING PUG MILLS

Heavy duty, twin-shaft horizontal mixers of extremely rugged construction. The counter-rotating intermeshing pug mill blades assure thorough blending, and the slicing action assures chemical treatment of every part of the batch. Patterson Processing Pug Mills are used to blend phosphate rock fines with water preparatory to plasticizing, for treatment of phosphate rock with phosphoric acid in the manufacture of super-phosphate fertilizer. It is suitable also for processing many other materials.



PELLETIZERS

Rotary type granulators and pelletizers, specially designed for thorough blending and granulating—assuring a uniform homogeneous product by complete blending of the coarse and fine material, as well as thorough distribution of the binder, if used. Spherical, free-flowing granules or pellets are produced, with a minimum of dust to separate in subsequent handling.

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The Patterson Foundry and Machine Company, (Canada) Limited
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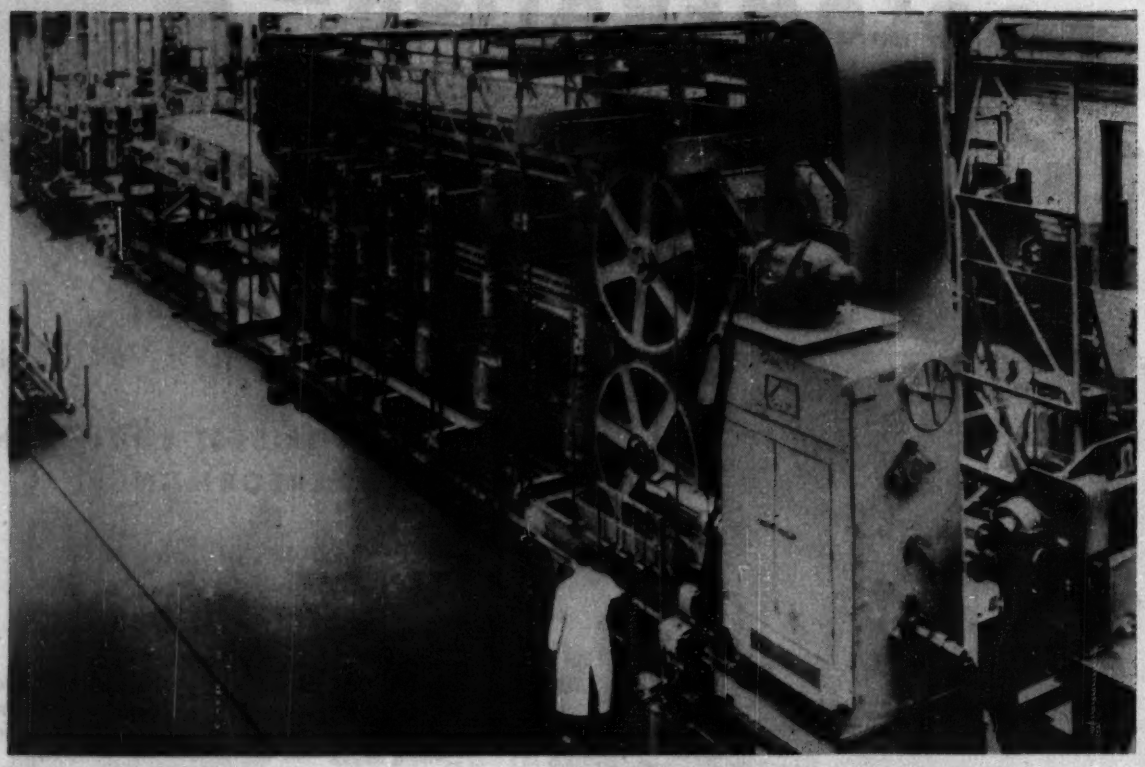


BARTREV PRESS utilizes wood particles from forest, mill or factory to continuously produce resin-bonded board.

Chips to Board—Continuously

New process turns out resin-bonded fiberboard as a 4-ft.-wide endless sheet. Special resin formulations and a giant new machine contribute to success of the process.

Rising demand by the construction industry set against a background of dwindling lumber supplies highlights the American debut of the Bartrev press—a machine that continuously converts wood and wood waste into high-quality, low-cost hardboard.

Now for the first time the fiber board industry has a process which combines scientific quality control with straight-line mass production. English developers of the process look for a revolution in hardboard and plywood comparable to those wrought by continuous processes for paper, flat glass, strip steel and aluminum.

The new machine, indeed, resembles a modern papermaking machine or continuous strip mill. Over-all, it's 131 ft. long, 20 ft. high, 7½ ft. wide and weighs about 200 tons.

The machines are being built in England. Already one machine has been operating continuously for six months. Sales agent for the U.S. is Aries Fiberboard Corp., 400 Madison Ave., New York. Price at dockside in New York will be approximately $750,000.

▶**Uses Special Resins**—In order to achieve machine speeds as high as 30 ft. per min., the process requires specially formulated thermosetting resins that cure completely during their short exposure in the press. All work in England to date has been with urea-formaldehyde resins, because of their economy. However, in this country other resins have been used.

Should the economic picture change, other types could be adapted to the process. The acid catalysts selected are slow-starting so that reaction will not start during preheating stages. However, once the high-temperature, high-pressure zone is reached, polymerization is rapid.

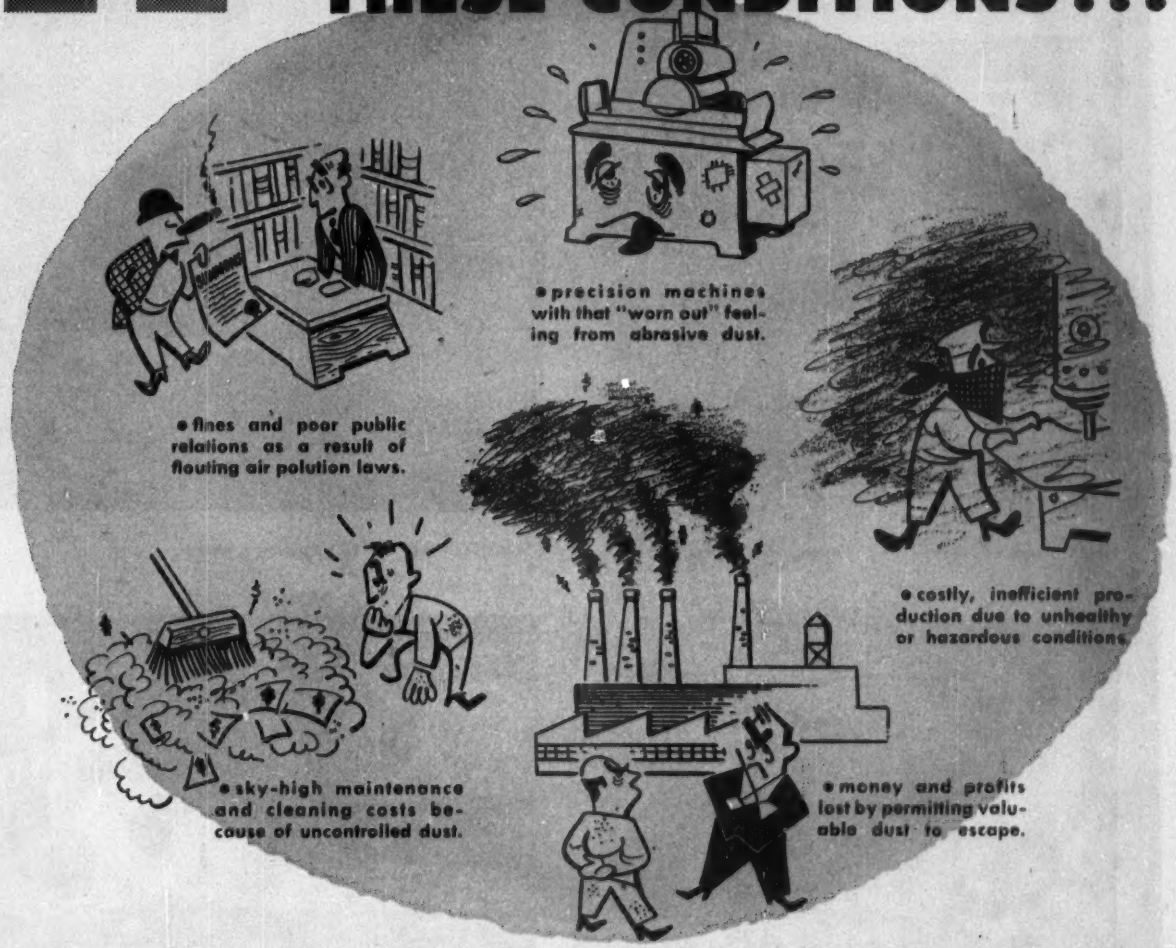
▶**About the Product**—Finished board can have a density identical with the original wood species, or it can be varied in either direction at will. Specific gravities are normally in the range of 0.5 to 0.8. Thicknesses range from $\frac{1}{16}$ to $\frac{1}{2}$ in.

In other respects the board combines advantages of natural lumber with some new ones of its own. It can be worked in the same way as standard boards and with the same tools and adhesives. Warp resistance is inherent, and modifications can be included to make it fire-retardant and pest-resistant.

As a low-cost core for wood veneers or plywood, Bartrev board is claimed to be outstanding. One veneer ply on each face is sufficient—no cross-plies are needed. The board can also serve as a core for plastic laminates. Decorative papers, textiles and metal foils can be bonded directly to it during manufacture.

▶**About the Equipment**—Component parts of the press itself include a chip hopper and feeder; a preheating zone supplied with a dielectric heater; a forming and curing zone with two endless stainless-steel belts backed up by heavy metal platens

IF YOU CAN "LAUGH-OFF" THESE CONDITIONS . . .


• precision machines with that "worn out" feeling from abrasive dust.
• fines and poor public relations as a result of flouting air pollution laws.
• costly, inefficient production due to unhealthy or hazardous conditions.
• sky-high maintenance and cleaning costs because of uncontrolled dust.
• money and profits lost by permitting valuable dust to escape.

. . . if these conditions don't faze you—then you don't need dust control!

BUT—if your plant can't stand these costly inefficiencies—(and we're sure it can't)—then dust control is a *must*.

Dracco Dust Control Systems are industry's finest—because of Dracco's custom design and application engineering. For over 35 years, American industry has relied on Dracco to solve tough, unusual dust problems.

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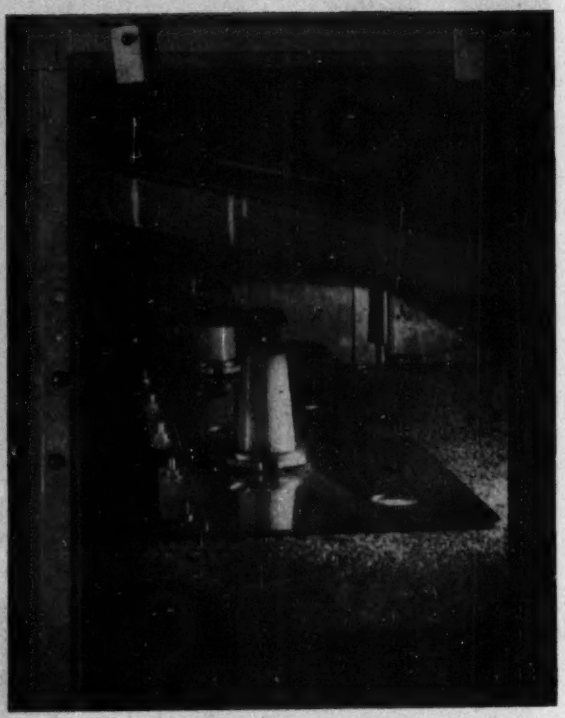
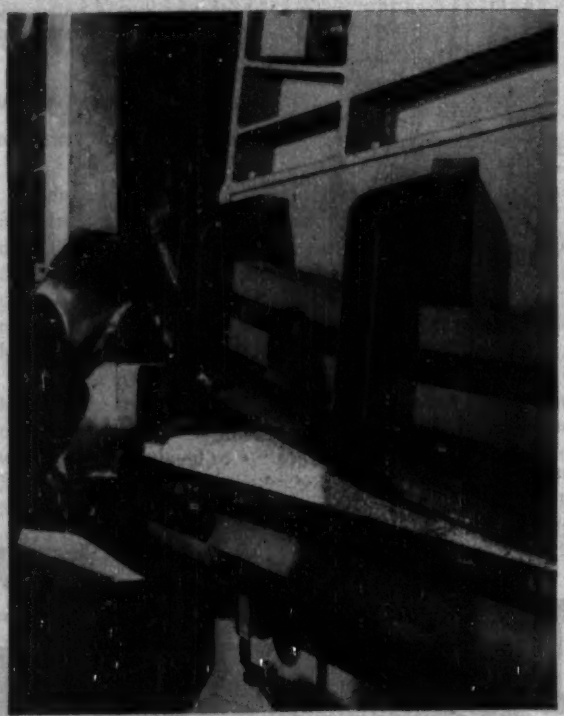
Airstream **CONVEYORS • DUST CONTROL EQUIPMENT**

Chips to Board—Continuously

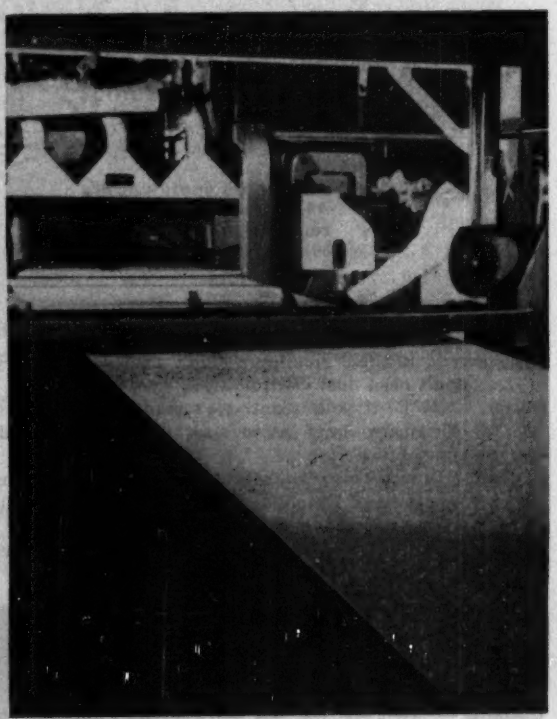
CHIPS go to mixer for resin addition.



CARPET OF CHIPS passes preheater.



MATERIAL enters compression zone.



FINISHED BOARD is cut to length.

(Story begins on page 130)

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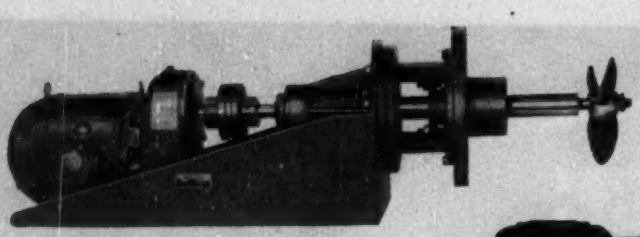
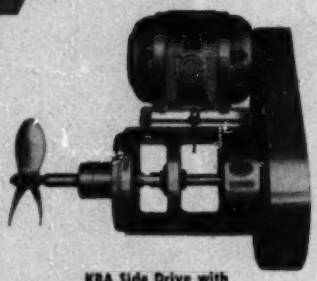
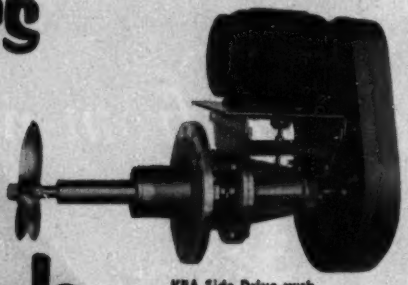


KBA Gearmotor Driven Side Drive

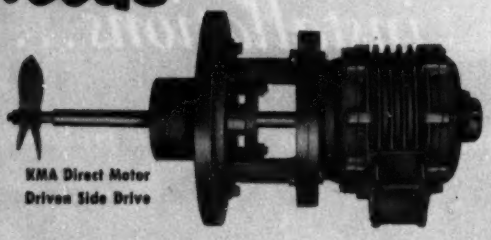
Side Drive Agitators to Suit your Needs



KBA Side Drive with special motor mount



KBA Side Drive with standard V-belt drive



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heated by radiant burners, together with pressure cylinders for squeezing the board between the belts; and a trimmer and traveling cut-off saw. Roll stands and adhesive coaters are suitably located for feeding webs of laminating materials onto the board.

In addition to the press, the process requires a materials preparation plant. This normally consists of storage bins, feeders, dryers, grinders, classifiers and mixers. Also included are resin measuring and blending units to provide a stock uniformly loaded with resin.

▶ **About the Process**—Design of the materials preparation plant depends upon the nature of the raw material. Dry material which is already in relatively small pieces (e.g., planer shavings) may need only grinding in orthodox hammer mills. Where the material occurs in large-size pieces special machinery is used to convert it into particles of any desired shape such as thin chips, shavings curlings etc. If the material is wet, as is the case with much forestry waste, it must be dried. Any of the common solids dryers can be used.

While these procedures permit a wide choice in raw materials, there are two qualifications—neither sawdust nor bark are desired. The particles are so small that they increase resin consumption beyond the economic point. Therefore, they are never used as primary materials. When they are present with other types of particles they can be removed by classification.

Properly sized wood particles are fed into a continuous mixer at a controlled rate. A 50-percent solution of resin is sprayed over the churning mass through high-pressure nozzles to give 4 to 8 percent dry resin based on the wood. Low-pressure steam is introduced to raise the stock temperature to 60 deg. C. and increase moisture content to 12 percent.

▶ **Meet the Press**—Stock is now ready for the forming operation. Mixer discharge drops into a hopper at the feed end of the press. By means of dams, screens and vibrators the feeder orients the particles within the mass and deposits a uniformly distributed layer onto a moving stainless-steel belt.

As the belt moves forward it carries the carpet of material between the electrodes of a dielectric heater.

Temperature of the mass is raised to 85-90 deg. C. At this point the acid catalyst in the resin starts to act and the resin commences to gel.

The hot mass then goes into the nip formed by the carrier belt beneath and another stainless belt above. From here to the end of the press the wood-resin mass is sandwiched between the two moving endless belts.

In the forming section each stainless belt is backed up by an endless chain of linked heavy steel platens. Specially designed bearings provide for belt movement and platen support.

The upper belt assembly is fixed vertically within the structure of the press. Hydraulic cylinders act upwards on the lower belt assembly, exerting the pressure necessary for board formation (300 psi. for density of 0.65 with shavings). Limit stops on the hydraulic cylinders govern the gap between the belts, and thus the final thickness of the finished fiberboard.

Gas or oil burners mounted within the belt loops supply radiant heat to the platens. Platen temperature reaches 160 deg. C.; the compressed material gets to 135 deg. Final curing of the resin within the compressed mass is completed by the time the board reaches the discharge point. Moisture content of the finished board is 8 percent.

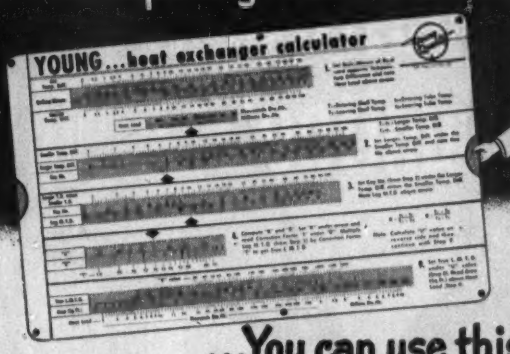
After leaving the forming stage the board is trimmed approximately ¾ in. on each edge to make a final width of 48 in. A traveling saw cuts pieces of any desired length from the endless sheet. Press speed varies from 9 ft. per min. for ¾ in. board to 30 ft. per min. for 3/16 in. board.

▶**Process Costs**—Economically the Bartrev process looks promising indeed. With a factory cost for finished board of $60 to $80 per ton the operator can afford to pay pulpwood prices for raw material, if necessa.'. This is predicated on a waste wood cost of $10 per ton, which is equivalent to a pulpwood cost of $15 per ton.

Resin would cost $20 per ton of product. Power required is 250 kwh. per ton. Labor, maintenance and depreciation account for the balance.

Sales of all presses will be based on actual pilot-plant trials on the prospective customer's raw material, followed by a full-scale run on the large press now in production in England.

If You Specify Heat Exchangers...



...You can use this

NEW YOUNG HEAT EXCHANGER CALCULATOR

Here's an invaluable aid for calculating and specifying Young Heat Exchangers. It shows the heat transfer coefficients for the shell side and tube side, which combined with proper fouling factors, determines over-all heat transfer coefficients. Also shows how Heat Exchanger size varies with fluid temperatures and velocities.

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For your Calculator and further details on the complete Young line of standardized Heat Exchangers, including Catalogs No. 1049 and 1149, see your nearest Young Representative.

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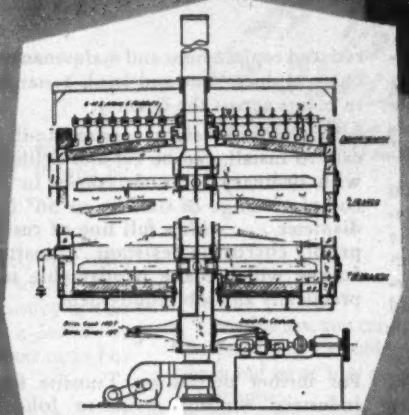

Skinner Roast - General Arrangement

for efficient roasting and calcining of ores, clays, limestone, limestone mud;

decomposing oil sludge in the process of recovering sulphuric acid; incinerating sewage and garbage.

COAL, OIL or GAS FIRED

Sizes:
plain hearths up to 21' 9" inside dia.
muffled hearths up to 15' inside dia.
suspension type roaster up to 22' 9" inside dia.
up to 12 hearths.

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this TRANSITE* Industrial Vent Pipe is good for many years more!

This 80-foot Transite stack vents corrosive gases from a trunk sewer in a large city. In excellent condition after 14 years of service, it has already outlasted the original metal breechings.

Typical of the long service life you can expect from Transite Pipe in solving tough venting problems, this durable asbestos-cement product successfully resists a wide variety of corrosive industrial fumes, gases and vapors which seriously affect other pipe materials in a short time.

Because Transite Industrial Vent Pipe is non-metallic and is therefore rustproof, it requires no maintenance —needs no paint or other protective treatment. Due to its unusually high chemical stability, it has substantially reduced replacement and maintenance costs in duct, vent and stack systems in plants across the country.

It is light in weight, easy to handle, easy to install, can be cut and drilled with ordinary tools. It comes in a complete range of sizes up to 36" in diameter . . . with a full line of rustproof, corrosion-resistant Transite fittings which make it adaptable to practically any job requirement.

* * *

For further details on Transite for industrial venting, write to Johns-Manville, Box 60, New York 16, N.Y. Ask for Data Sheet Series DS-336. In Canada: 199 Bay Street, Toronto 1, Ontario.

JM

*Transite is a registered Johns-Manville trade mark

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TRANSITE Industrial Vent PIPE

Commercial Solvents Opens Ammonia Plant in Louisiana

Opening of its new ammonia plant at Sterlington, La., will double present output of nitrogen by Commercial Solvents Corp. for agricultural and industrial use. In addition to anhydrous ammonia, the new units will produce nitrogen solutions for mixed fertilizers and crystalline ammonium nitrate for direct application to the soil.

Built at a cost of $20 million, the new facilities of Commercial Solvents will soon be turning out nitrogen fertilizers for the nation's farmers. The Sterlington plant is part of the chemical industry's privately financed nitrogen expansion aimed at a 70 percent increase in production by 1956.

Minnesota Mining Acquires Subsidiary in Electronics

Minnesota Mining & Manufacturing Co. has acquired American Lava Corp. of Chattanooga, Tenn., through a $5 million stock transfer. American Lava stockholders have traded their common and preferred shares for 3M common.

Prime reason for the acquisition by Minnesota Mining was to broaden its participation in the fast growing electronics industry.

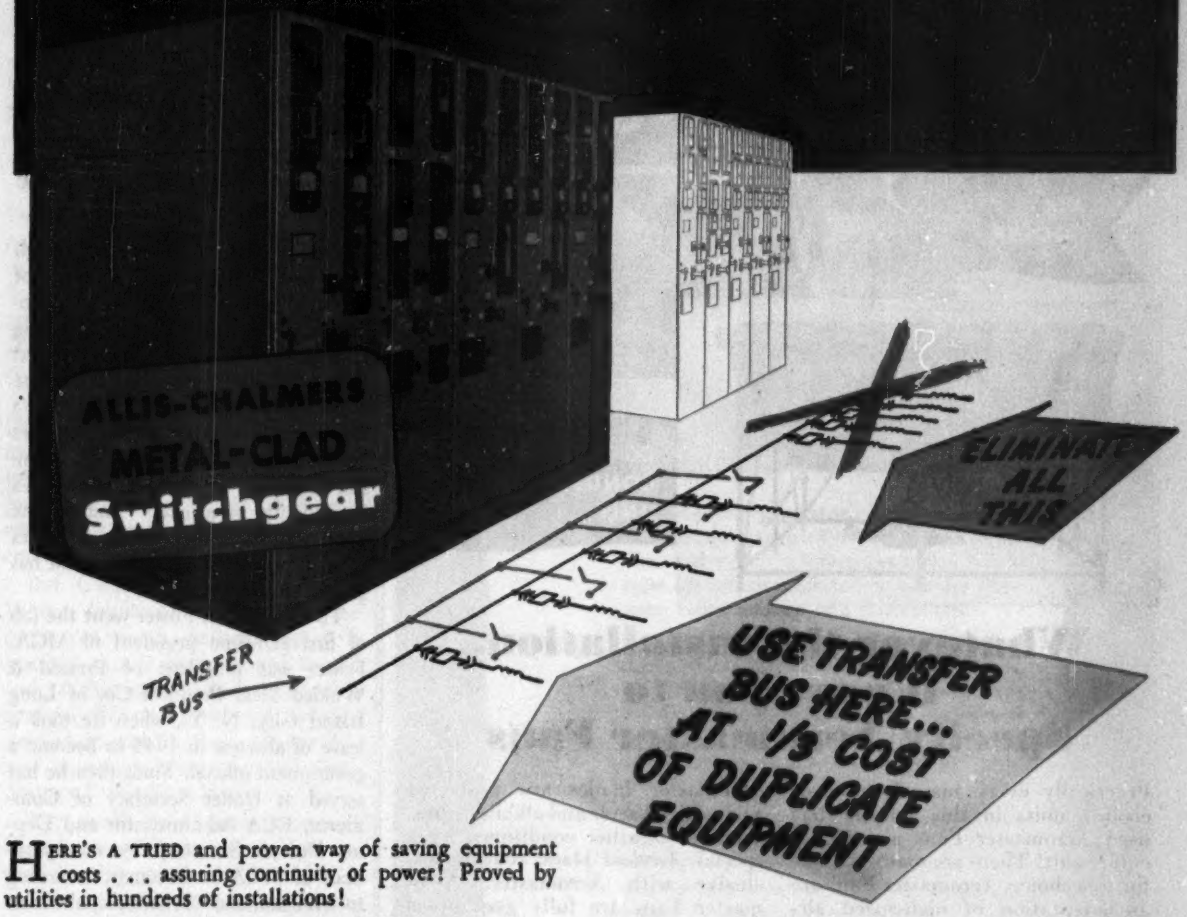
"We are the world's largest producer of flexible electrical insulating materials," says President Herbert P. Buetow of Minnesota Mining. "The electronics industry is already a giant on the American business scene and many phases of its development are just beginning. By joining forces, 3M and American Lava will play a far larger role in the industry than they could hope to play separately."

American Lava's production of ceramic insulators dovetails with the business 3M has developed through its electrical insulating materials and sound recording tapes.

Like 3M, American Lava was founded in 1902. It produces more than 40,000 types of electrical insulating materials, mostly for radio and television components. Most of its products are marketed under the name AlSiMag. The company also makes crucibles, nozzles and chemical-resistant fittings for the thermal and chemical industries.

In addition to tapes, Minnesota Mining makes abrasives, adhesives, re-

Why Buy Duplicate Switchgear to Assure Power Continuity?



HERE'S A TRIED and proven way of saving equipment costs . . . assuring continuity of power! Proved by utilities in hundreds of installations!

What is a Transfer Bus?

It's simply a by-pass bus circuit that parallels the main switchgear bus. A switching means is provided so that loads can be transferred to the transfer bus. It's a standby in case anything happens to the main bus. Also, makes it possible to withdraw and maintain circuit breakers, or inspect main bus without power stoppage.

What are Other Advantages?

1. Saves Cost. Transfer bus costs about ⅛ as much as the additional equipment needed to provide duplicate switchgear to do this same job.
2. Cuts Space in Half. Allis-Chalmers supplies transfer bus in same cubicle as switchgear without adding cubicles. Thus an Allis-Chalmers installation cuts space one-half.

In addition, you can insure against failure of power source by providing a double end feed with the one set of switchgear and be as sure of power supply as if you had duplicate switchgear.

Depending on the job you want to do, there are many arrangements that Allis-Chalmers can provide. In many cases, the engineering has already been done.

Ask an Allis-Chalmers engineer about transfer bus arrangements and what they can mean to your plant in savings and service. Call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3731

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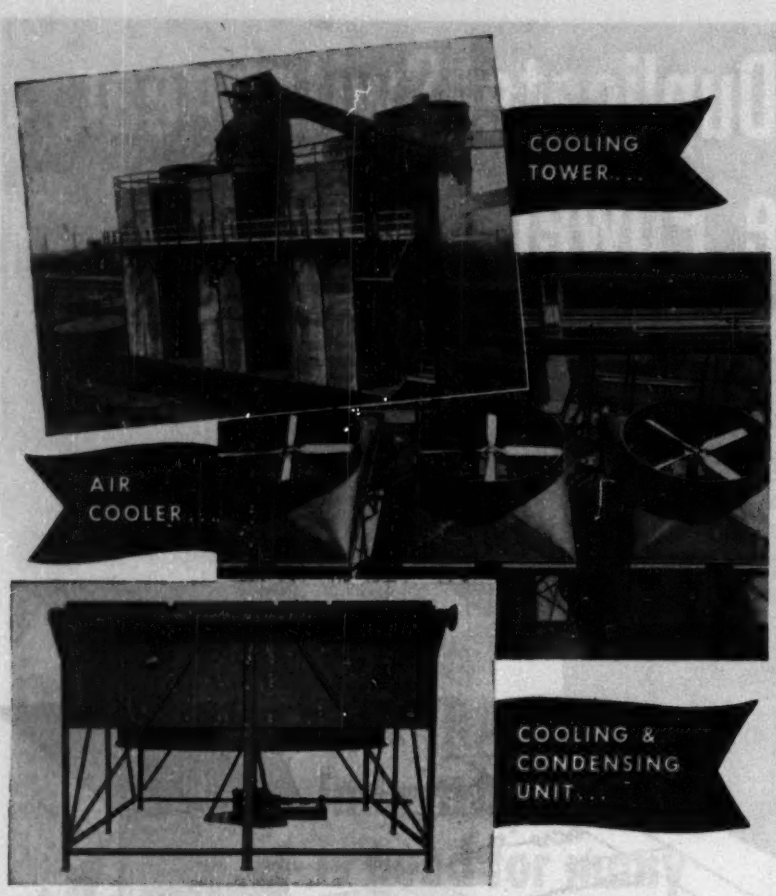
First in the U. S. with Metal-Clad Switchgear



Whatever the installation, it pays you to Specify Aeromaster Fans

Practically every manufacturer of cooling units in this country has used Aeromaster Fans as original equipment! There are many reasons for this choice. Aeromaster Fans are an adaptation of high-speed aircraft propellers—precisely prebalanced, with an easily adjustable blade pitch to meet changing power requirements. They give you top efficiency and improved anti-flutter performance . . . require less horsepower to operate.

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Title _____ Company _____

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flecting products, graphic arts accessories, roofing granules and chemicals.

No change will be made in the management of American Lava or in its operating policies. John Kruesi will continue as president of American Lava. All other officers and executives will likewise retain their positions. Robert L. Westbee, general manager of 3M's electrical insulating and sound recording tape division, will be responsible for liaison between parent company and subsidiary.

Chemical Makers Optimistic Despite Record Expansion

Expanded production capacity, high taxes and lower tariffs were some of the problems tackled at the 81st annual meeting of the Manufacturing Chemists' Association held recently at White Sulphur Springs, W. Va. More than 500 of the chemical industry's top executives from 100 companies heard Air Reduction's Charles S. Munson reaffirm his belief in MCA's "sound rate of progress" and outline plans for expanded MCA activities to keep pace with an industry that has grown fourfold since 1939.

To William C. Foster went the job of first full-time president of MCA. Foster was president of Pressed & Welded Steel Products Co. of Long Island City, N. Y., when he took a leave of absence in 1946 to become a government official. Since then he has served as Under Secretary of Commerce, ECA Administrator and Deputy Defense Secretary. As new president of MCA he becomes, according to Munsun, the "dynamic spokesman for a dynamic industry."

Munson, the retiring president, becomes chairman of the board of MCA, succeeding William H. Ward of Du Pont. Fred J. Emmerich, president of Allied Chemical & Dye, was made vice chairman. Members also elected two new vice presidents. They are Paul L. Davies of Food Machinery & Chemical Corp. and Kenneth C. Towe, of American Cyanamid.

Anxiety over the growing productive capacity of the chemical industry frets some chemical executives. The current $6 billion expansion to be completed by 1955 comes on top of a $5.5 billion plant expansion for chemicals between 1946 and 1951. An industry boom such as this in chemicals is unprecedented in the nation's history.

Hence the apprehensiveness of certain executives about excess capacity for chemicals.

They weren't reassured when Cecil C. Merrifield of the Econometrics Institute of New York told MCA members at White Sulphur Springs that he expected a 5 to 6 percent dip in the Federal Reserve Board index of industrial activity in the last half of this year. He pointed out to the chemical manufacturers that the arms boom is now largely over, that steel ingot production is running ahead of consumption, and that automobile sales are slumping and forcing cutbacks.

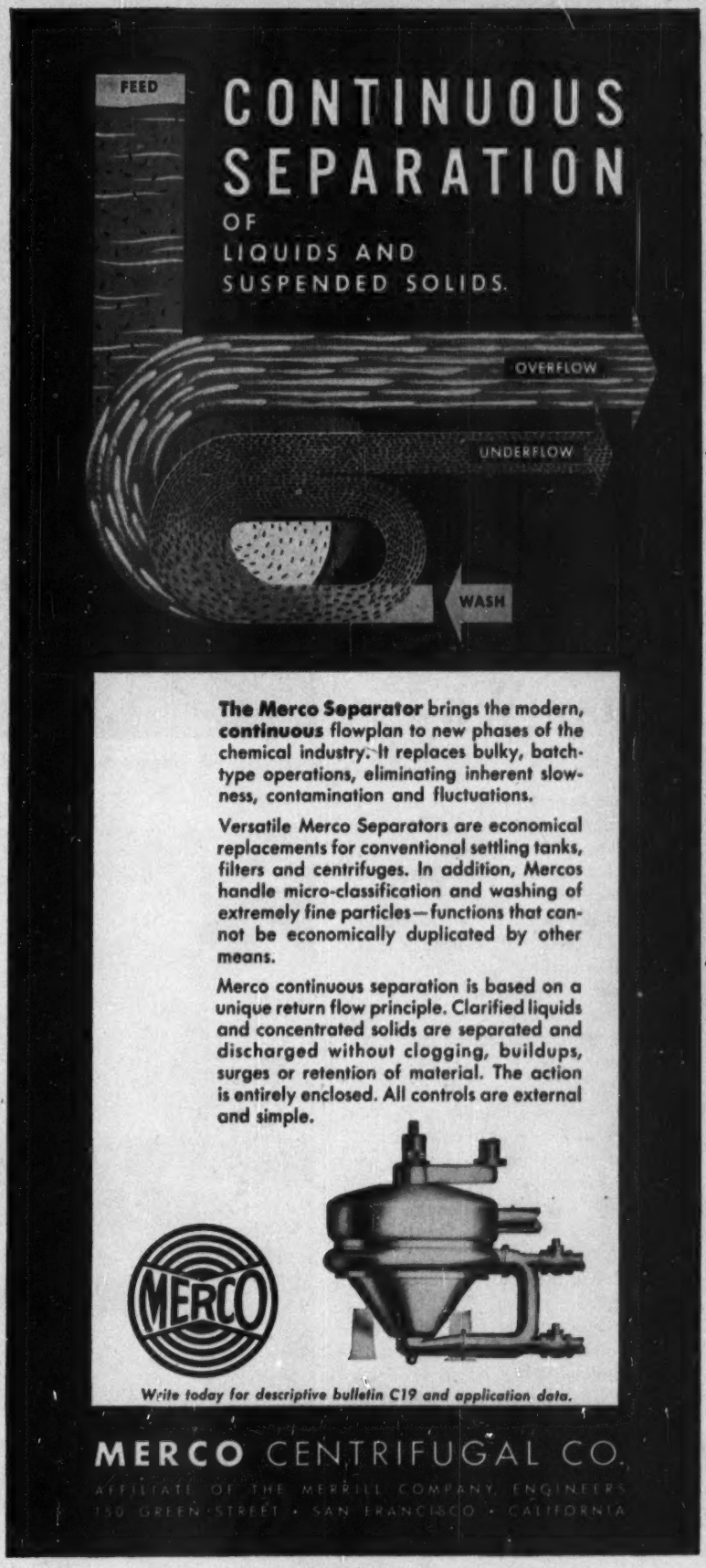
Other MCA members, among them Du Pont's J. Warren Kinsman, while not discounting these forebodings, were more sanguine. They feel sure that the growing diversity of end uses and the opening up of new markets, plus population growth, will take care of the mounting output of chemicals.

High taxes continue to plague the chemical industry. For the industry as a whole, taxes take a 58 percent bite out of profits. And the excess profits tax eats up as much as 82 percent of the profits from new chemical enterprises experiencing rapid growth.

But Commerce Secretary Sinclair Weeks, despite his opposition to the excess profits tax, declared that it is essential that it be continued to the end of this year. "An unreasonable demand for premature tax relief—sparked in part by truce prospects—may injure our chance to nail down solvency," Weeks told the MCA.

The Synthetic Organic Chemical Manufacturers' Association held its annual meeting jointly with the MCA at White Sulphur Springs, and members of both organizations turned out for the panel discussion on tariffs. Howard R. Huston of American Cyanamid was moderator, and other panel members were Donald O. Lincoln, SOCMA counsel; Cary R. Wagner, president of SOCMA; Fred G. Singer of Du Pont, chairman of MCA's Committee on International Trade and Tariffs; and B. M. Reynolds of Merck, also of the committee.

Makers of synthetic organics are warily eyeing proposed tariff revisions that might discourage full-scale U. S. output. The break-even point for some capacity is about 85 percent today; industry spokesmen argue that lowering tariff barriers could undercut current research and development costing $150 million a year.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Versatile Merco Separators are economical replacements for conventional settling tanks, filters and centrifuges. In addition, Mercos handle micro-classification and washing of extremely fine particles—functions that cannot be economically duplicated by other means.
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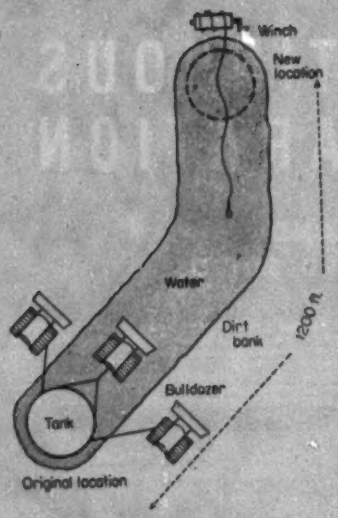


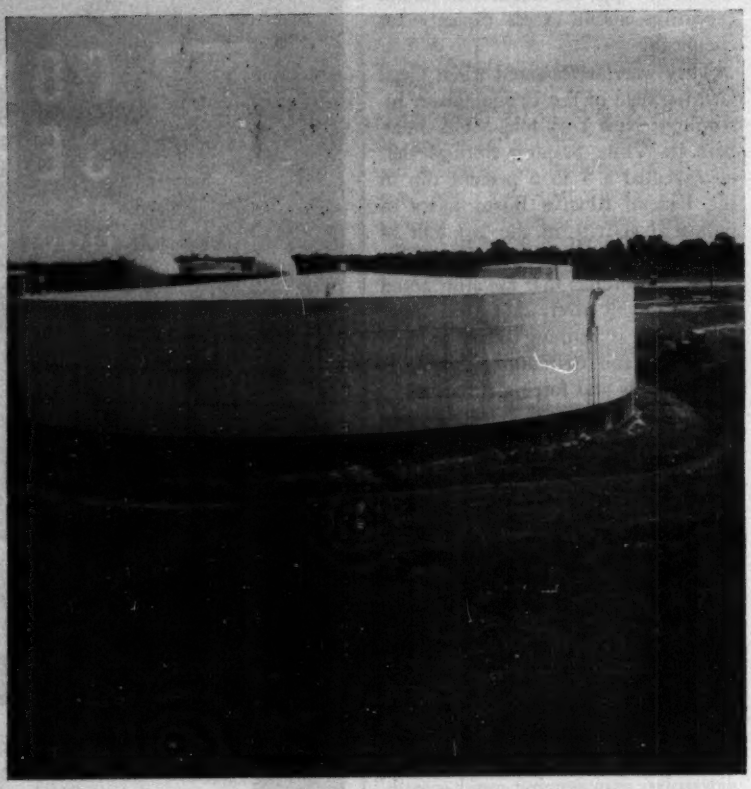
Shell Moves A Tank the Easy Way

To make room for a new cat cracker, engineers at Shell's Norco Refinery, Norco, La., moved a large oil tank from its original location to a new location by floating it over a homemade waterway. They figured the 1,200-ft. over-all haul was cheaper than dismantling and then reassembling the tank on its new base. It was also more practical, it seems, to float the big 84,000-bbl. tank than to skid or wheel it over the distance.

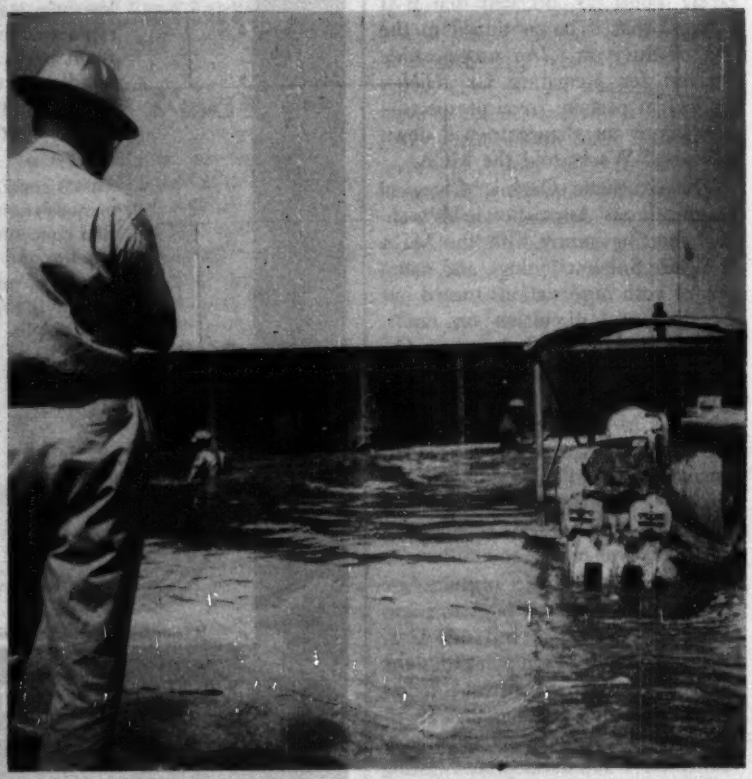
Bulldozers first smoothed off the general area and laid up a five and one-half foot levee of piled earth along marked boundaries. Water was next pumped into the canal-to-be—about 18 million gallons.

To free the tank from its base, water was first pumped into the tank and then drawn through five welded plugs in the tank bottom. Next the plugs were closed, and the tank set afloat.

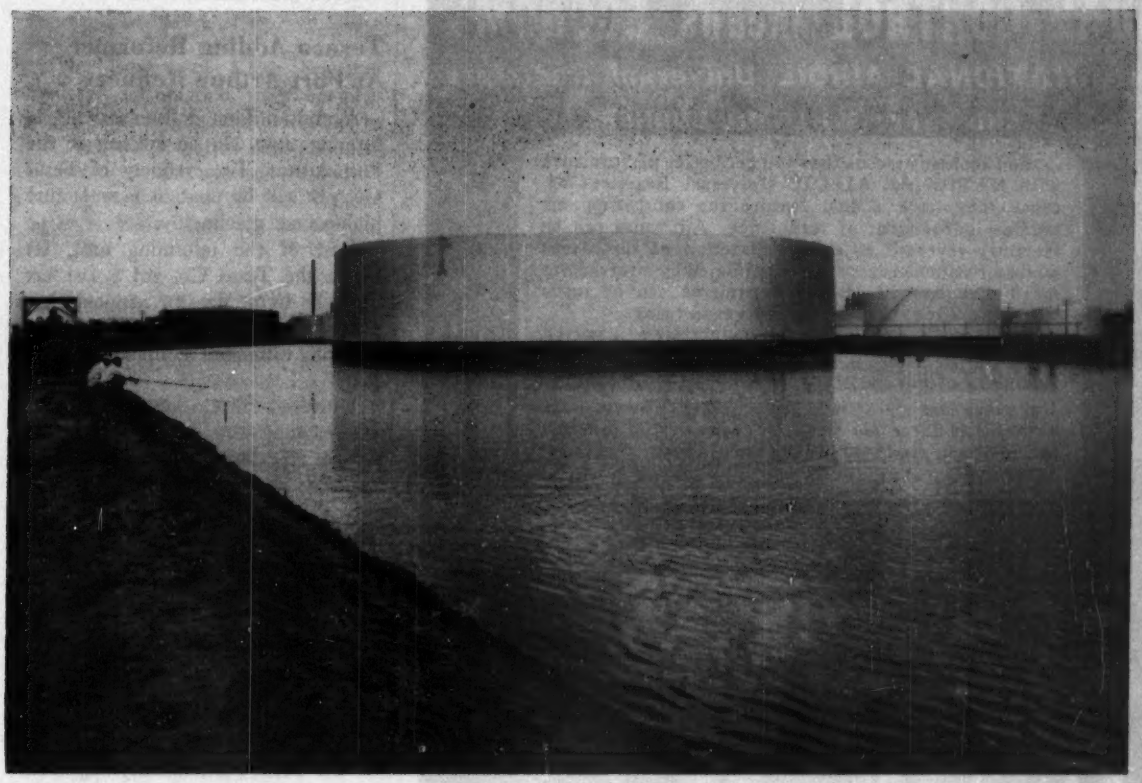
A bulldozer then entered the waterway, and with the aid of two other guide bulldozers on each side of the levee, towed the tank around a dog leg where a winch took over. The winch then drew the tank between guide posts into its new position. Once in position, the plugs were removed and the tank settled evenly.



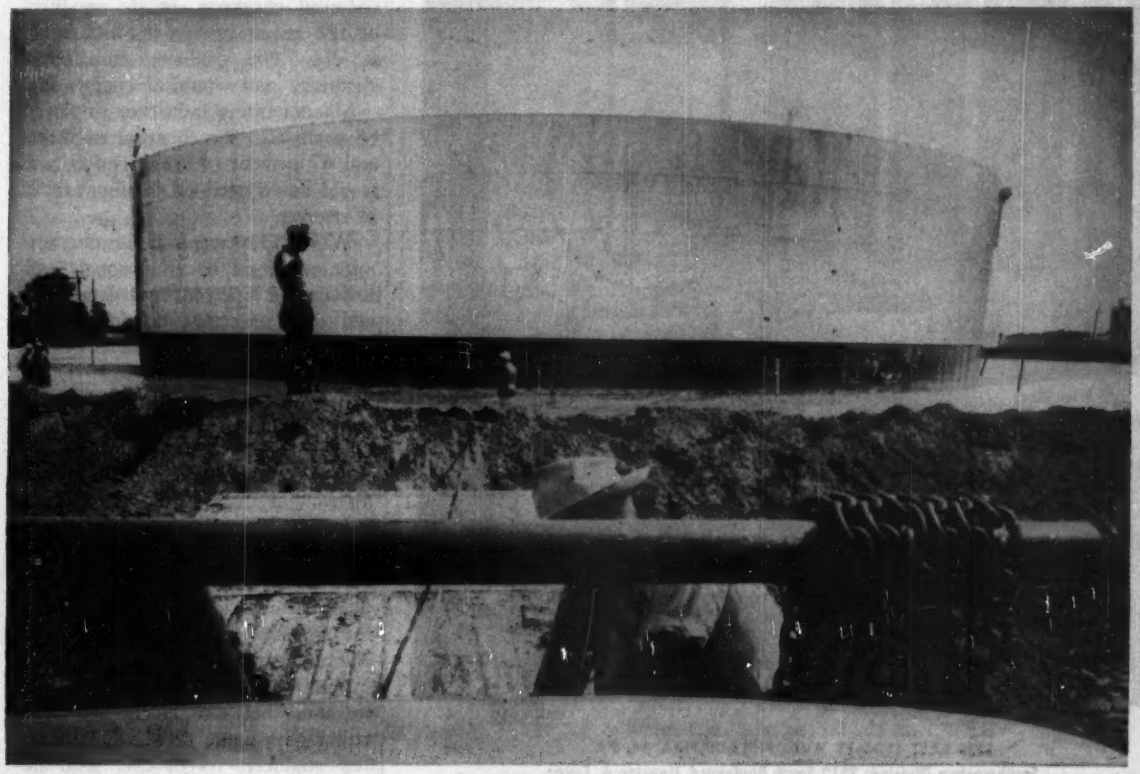
Bulldozer prepares ground . . .



. . . moves into position



It then starts hauling . . .



. . . until a winch takes over

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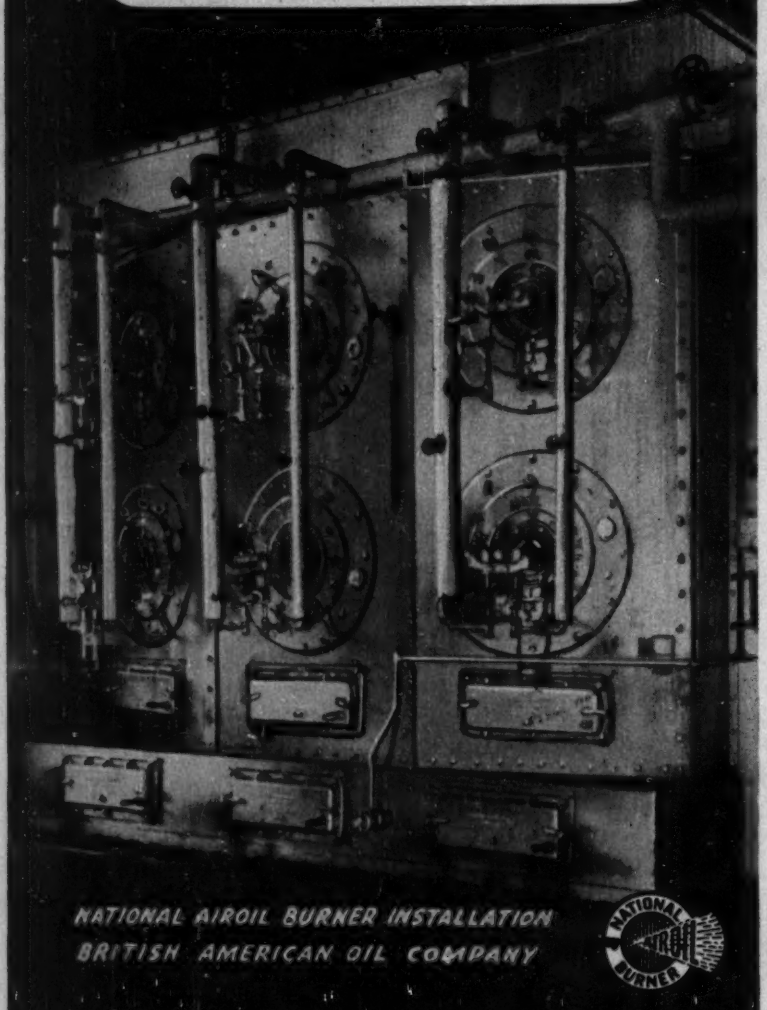
Another "dual advantage" of NATIONAL AIROIL Universal Registers is that they are equipped for dual fuel firing of gas and oil.

Universal Registers with Type "S-A-L" Burners are available in three (3) sizes . . . capacities up to 60,000 lbs. of steam produced per burner per hour. Write for Bulletin 51.



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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

Texaco Adding Reformer At Port Arthur Refinery

A multi-million dollar catalytic reforming unit will be erected at the Port Arthur, Tex., refinery of Texas Co. It will be used to manufacture high-octane gasoline.

Cost of the reforming unit, for which the Texas Co. got a fast tax writeoff from the government last year, has not been disclosed. However, it's estimated at up to $16 million.

Universal Oil Co. of Chicago, Ill., is designing the catalytic reformer, which is expected to be ready for operation before the end of 1954.

Recall of Engineers Could Hurt Defense Industries

A general call-up of reserves would drain U.S. industry of many of its chemists and chemical engineers, warns the Bureau of Labor Statistics. One out of four chemical engineers and one-sixth of the chemists were in the reserves when they registered with the National Scientific Register.

Close to 52,000 chemists, over half the U.S. total, and about 13,000 chemical engineers, nearly one-third of the entire profession, responded, as did 7,000 graduate students in chemistry and chemical engineering.

Manufacturing industries employed 84 percent of the chemical engineers and 67 percent of the chemists, and would be crippled by an all-out recall of reserves.

While 14 percent of the chemists were employed by educational institutions and 8 percent by federal, state and local governments, only 4 percent of the chemical engineers worked in each of these fields.

Earnings of chemists and chemical engineers have climbed since, but median annual income at the time of registration in mid-1951 was $5,500 for chemists and $5,600 for chemical engineers.

Chemists under 25 had a median income of $3,400; median earnings increased with age to a peak of $7,900 for chemists between 55 and 60. For chemical engineers under 25, median income was $3,700, rising to $11,700 for those between 60 and 64 and a still higher figure of $15,000 for the few engineers 65 or over who furnished income information. In both

professions, Ph.D.'s had higher average earnings than persons with only a B.S.

The Bureau of Labor Statistics analyzed information from chemists and chemical engineers received by the National Scientific Register. This registration of technical manpower became a function of the National Science Foundation in January of this year.

Oklahoma Plant Will Make High-Abrasion Black

Continental Blacks, Inc., a newly organized company, will build a $2.75 million plant at Ponca City, Okla., designed to manufacture 40 million pounds annually of high-abrasion black from oil.

Joint owners of the new enterprise will be Continental Oil Co., the Shamrock Oil & Gas Corp. of Amarillo, Tex., and Robert I. Wishnick of New York.

Construction of the carbon black plant, which will get its raw materials from Conoco's refinery at Ponca City, starts this summer. It's expected to be completed by mid-1954.

Witco Chemical Co. of New York will handle the marketing of high-abrasion black from the new plant.

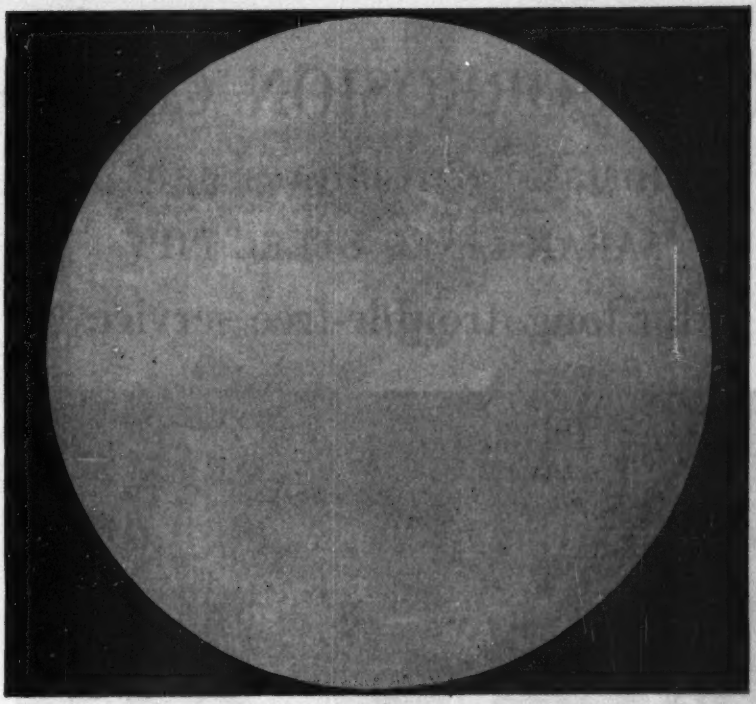
Prime use for high-abrasion black is in the rubber industry for the production of rubber tires. A small percentage goes into other industrial rubber products. It's also used as a black pigment to color inks, plastics and other products.

Continental Oil Co. is co-owner of Continental Carbon Co., which operates carbon black plants at Eunice, N. M., and Sunray, Tex., and of Continental Oil Black Co., operator of an oil black plant at Lake Charles, La.

Canadians Trying Flotation To Concentrate Uranium Ore

An economical way is sought to concentrate low-grade Saskatchewan uranium ores. Flotation, followed by leaching of the concentrates, may provide a method, according to chemical engineers at the University of Saskatchewan.

Results reported by I. J. O. Korchinski, G. A. Graig, E. B. Tinker, S. D. Cavers and A. B. Van Cleave, all of the university, at the recent Windsor, Ontario, meeting of the Chemical Institute of Canada are encouraging enough to suggest that "it may be



NFM Announces New Filter Paper

"NETONE" Paper Shows High Tensile and Bursting Strength — Good Chemical Resistance

"NETONE" Filter Paper is a neoprene impregnated kraft paper that offers decided mechanical and chemical advantages over standard filter papers.

When compared to 60-pound unbleach kraft "NETONE" Filter Paper shows a 500% increase in wet tensile strength, wet burst factor increases from 6 to 57 and there is a marked increase in abrasion and crease resistance.

Write us about your requirements and we will be glad to send samples for your testing.

...And for your filter cloth requirements, we weave VINCEL*, SARAN, DYNEL, NYLON, ORLON**, VINYON N† and GLASS. Samples sent on request.

Solution	60-Pound Kraft	Wet Strength Resin	Neoprene Treated (3%)
H_2O	0	72 hr.	86 hr.
10% HCL	0	6 min.	4 hr.
10% NaOH	0	6 hr.	72 hr.

*T.M.—Nat'l Filter Media Corp.
**T.M.—E. I. du Pont de Nemours Co.
†T.M.—Union Carbide & Carbon Corp.

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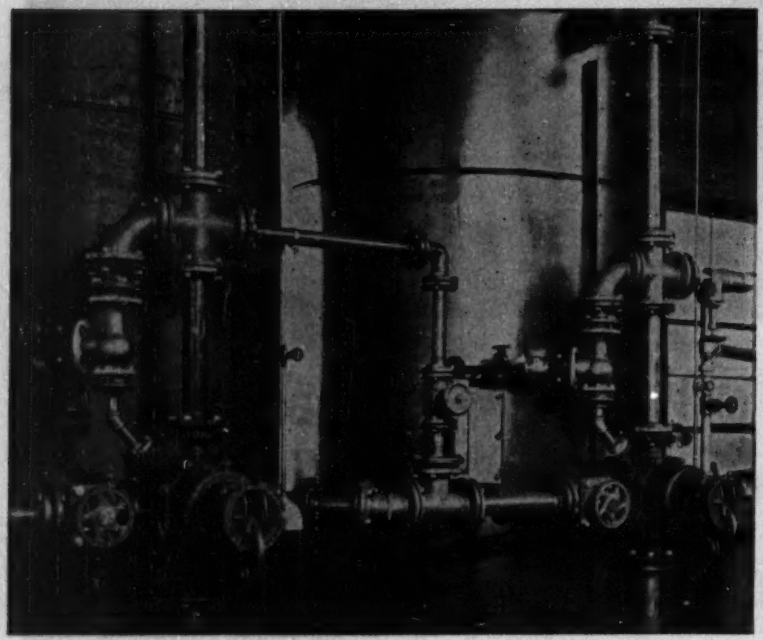
install corrosion-resistant SARAN LINED STEEL PIPE for long, trouble-free service



Saran Lined Pipe, Fittings and Valves are used in this automatic water deionizer in a large water purification system. Installations such as this give trouble-free service for many years.

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Please send me a copy of your catalog on Saran Lined Pipe, Valves and Fittings.

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Corrosion-resistant Saran Lined Steel Pipe sharply reduces repair and maintenance costs in corrosive piping installations. Downtime is cut to a minimum because this rigid pipe has high pressure strength and durability—which mean dependable, long-term service. Easily installed Saran Lined Steel Pipe can be cut and threaded in the field—no need for special tools or handling. Wherever superior resistance to most chemicals and solvents is demanded, be sure to consider Saran Lined Pipe, Fittings and Valves. Write to the distributor: SARAN LINED PIPE COMPANY, 2415 Burdette Avenue, Ferndale, Michigan. Offices in: New York • Boston Pittsburgh • Tulsa • Philadelphia Chicago • Portland • Indianapolis San Francisco • Houston • Denver Los Angeles • Seattle • Cleveland Charleston, S. C. • Toronto • Montreal. Clip and send today!

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possible to concentrate these uranium ores by flotation."

Although the concentrates obtained have a very low uranium content, the Saskatchewan researchers believe that "if leaching were to be used as a step in the recovery process even a twofold concentration of the ore would result in worthwhile savings in handling costs."

The northern half of Saskatchewan, says Dr. Van Cleave, forms part of the Pre-cambrian shield and is already the site of two producing mineral mining operations. "One of these is at Flin Flon, Manitoba, where most of the ore comes from the Saskatchewan side of the provincial boundary. The other operation is at Beaverlodge, where the Eldorado Mining & Refining Co. has recently begun the mining and concentration of pitchblende ore on a large scale."

It's expected, Van Cleave points out, that at least one more mining operation for uranium ore will be developed in the Beaverlodge area. Other uranium finds have been located elsewhere in Saskatchewan, including Charlebois Lake, Black Lake, Nunn Lake, Freda Lake, Lac la Ronge and Foster Lake. Considerable prospecting is expected this summer, particularly in the Beaverlodge and Foster Lake regions.

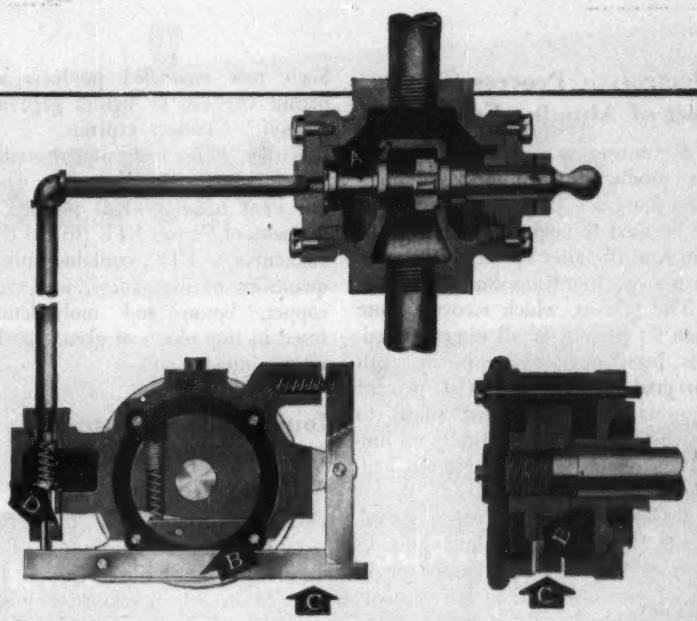
Seeking a way to concentrate low-grade uranium ore from the large deposits of Charlebois Lake, Van Cleave and the other University of Saskatchewan chemical engineers decided to try flotation.

"Although Canadian uranium ores have so far not responded well to preconcentration by flotation," they believe this method, followed perhaps by leaching of the concentrates, affords the best chance of economical recovery of the uranium.

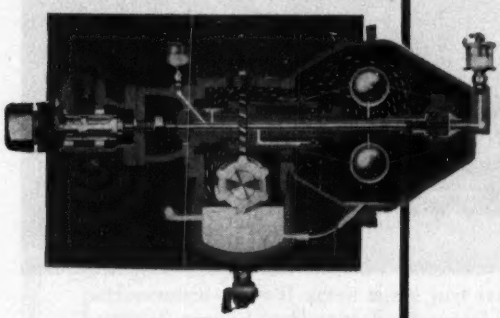
In the flotation operation, particles of one mineral are floated by air bubbles from a suspension of particles of two or more minerals in water. The surface of the mineral to be floated is first coated with a substance called a collector. Frothers, depressors, activators and other reagents are also used in the flotation process.

So far, the Saskatchewan researchers have been unable to find a completely satisfactory collector for the flotation of this ore. However, their results suggest that these low-grade uranium ores can be concentrated by flotation.

Only Coppus Turbines offer you *a pilot operated* excess speed safety trip



The constant speed governor on Coppus Turbines, plus this Excess Speed Safety Trip, gives you extra protection for your turbine investments. Here's how it works. When steam is turned on, pressure opens valve A fully. When excess speed is reached, centrifugal force throws weight B against lever C lifting pilot valve D. This releases pressure in back of valve A, closing this valve instantaneously, to shut off the steam. Safety trip can be tested easily while turbine is running by manually tripping and resetting lever C.



Sectional view showing lubricating system of fully enclosed Coppus Constant Speed Governor. Governor head acts directly on stem of steam admission valve. No external levers required. Ball bearing construction eliminates end play and gives frictionless operation.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

CUT YOUR COSTS PER HORSEPOWER

When you choose from the Coppus Steam Turbine line, you get the right size for your requirements . . . and make substantial savings on *any* size from the 150 hp turbine down to the smallest. Low in first cost, Coppus Turbines save you more money in the long run. Operating and maintenance costs are kept low by such other features as: large number of steam nozzles, controlled individually by manually operated valves; hard chromium plating on shaft at the stuffing box; replaceable cartridge type bearing housings; optional carbon ring packing assembly for back pressures up to 75 pounds.

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORPORATION, 228 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

Electrolytic Process Cuts Cost of Alumina From Clay

A continuous electrolytic process for producing high-purity alumina from low-grade U. S. ores is ready to be licensed through Lobeth Corp. of Chicago, Ill., after operating for more than a year in a European pilot plant.

The process, which recovers more than 99 percent of all reagents used, has been operated purposely with low-grade kaolin clay (10 percent alumina and 80 percent silica) to prove that there is practically no limitation on the impurities it can handle.

Preliminary cost estimates, according to Lobeth Corp., point to production of 99.9 percent alumina at 15 to 20 percent less than from bauxite by the Bayer process.

Costs for the Lobeth process are based on actual pilot-plant tests in Europe, and are converted to U. S. dollars. Electrical requirements, according to Lobeth, are less than 2 kwh. per lb.

Aluminum Coated With Frit Will Find Many Markets

Ferro Corp. of Cleveland, Ohio, world's largest manufacturer of porcelain enameling frits, will make and market a new frit developed by Du Pont for coating aluminum. Du Pont researchers have developed a method for meeting the lower melting requirements of aluminum enamel coating—about 1,000 deg. F. compared to standard frits, used on steel, which are processed at around 1,500 deg. F.

New architectural and industrial uses for aluminum coated with porcelain enamel are expected to open up. "New needs for ceramic coatings for colors, corrosion resistance, abrasion, thermal shock, impact and flexing, as well as ease of fabrication have already been widely expressed by builders and industrialists," says President C. D. Clawson of Ferro.

"Under our new agreement with Du Pont," says Clawson, "we expect to begin production in about 30 days and our facilities will be expanded as rapidly as market needs require. The new material can be applied with ordinary enameling and firing procedures after the aluminum is prepared, except that lower temperatures must be used. Such new enameled products will permit the use of lighter gage aluminum," Clawson explains.

Earlier, Ferro had entered another agreement with Du Pont under which Du Pont handles small package retail sales of Ferro's FTE (fritted trace elements). FTE contains minute quantities of manganese, iron, zinc, copper, boron and molybdenum, fused in tiny pieces of glass, for slow release into the soil.

Ion Exchange Process Recovers Chromic Acid

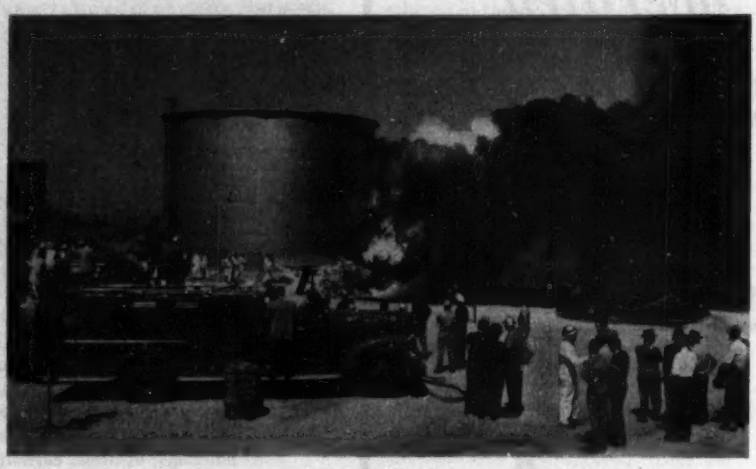
Ion exchange can be used in the electroplating industry to recover chromic acid from rinse water. Barnstead Still & Sterilizer Co. of Boston, Mass., has developed a process whereby rinse water can be passed through ion exchange resins to effect nearly 100 percent chrome recovery.

Advantages are twofold. First, the troublesome chromic acid waste disposal problem is eliminated. Second, the costly and often scarce chromic acid is recovered for further use.

In the process, the rinse water is first passed through a cation column to remove aluminum and copper, and then through an anion resin bed that removes the chromic acid. The chromic acid is then recovered in the regeneration process.

Tests show that the same resins can be used economically for 100 or more cycles.

Savings in chromic acid will, in most instances, more than repay the operating costs of the entire process. This means that the waste disposal problem can often be solved at virtually no cost. In addition, as a by-product of the process, the user gets demineralized water that he can use in rinse tanks and solutions.



To Snuff Out Refinery Fires

This new $40,000 fire truck, here going through its paces at the Wilmington, Calif., refinery of Richfield Oil Corp., does it in seconds. Fighting oil and gas fires three ways, singly or in combination, it smothers them by dry chemical, foam or water.

Four 1-in. lines can spray 1,300 lb. per min. of sodium bicarbonate from two 1,000-lb. tanks. Foam from an 800-gal. tank is automatically mixed with water in proportions of 5 to 15 percent foam with 95 to 85 percent water. This expands 16 to 20 times, producing 250,000 gal. in 13 min. The pump, powered by a 276-hp. engine, can send 1,800 gpm. of water streaming through the eight 2½-in. lines for water or foam.

Dry chemical works well against fires atop flues, gas tanks or in other inaccessible places. Foam is especially effective in blanketing flames on the ground, while water by wetting down oil and gas fires keeps them from spreading.

Truck and equipment weigh 30,600 lb. One man can operate the apparatus, but the truck carries equipment for 40 smoke eaters.

OUTSTANDING FEATURES

OF ORONITE'S DRY AND LIQUID SURFACTANTS

Better D-40—flakes, granules or powder

High Detergency
Rapid Wetting
Thorough Emulsification
Excellent Dispersion
Fast Penetration
Stability in Solution

Compare new, better D-40 for efficiency and performance—you'll agree there just isn't a better all-around surfactant. Economical D-40 is almost odorless, has a whiter white color, is caking resistant, has high foam stability in presence of grease. Oronite's higher active D-60 is also better than ever.

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Easy Rinsing—No Residue
Fast, Thorough Wetting
Exceptional Detergency
Neutrality and Stability
Solubility and Dispersibility
Compatibility ***with Anionic and Cationic Compounds***

New water-soluble Dispersant NI-W is a clear, light-colored nonionic surfactant. It is both heat and chemically stable—effective in hard or soft water. Very adaptable for manufacture of economical, high-quality formulations. Its new companion product, Dispersant NI-O, is an outstanding emulsifier for water-in-oil emulsions.

Contact nearest Oronite office for product data and samples.

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Pro and Con

HOGGED fuel gives cleaner furnace operation.

Pro: New Smelting Technique

Sir:

Your June issue (p. 122) describes the new Rasmussen electric furnace smelting technique for using hogged fuel (wood waste) in place of coke for the production of certain electrothermal products . . . an interesting and ingenious development that, to me, seems especially significant to the ferroalloys industry.

Several points in the story intrigue me (such as how the sawdust dilutes the volume of the ore charge at least 6-fold and indirectly makes better use of power input). But I don't get the idea how Rasmussen's method makes for a cleaner furnace operation. . . .

KEN H. MILLER
Chemical Engineer
Bellingham, Wash.

▶ *The photograph above shows how hogged fuel—in place of a good part of the coke or charcoal normally used—gives a clean furnace operation.*

The reason: A porous, dry top cover of unfused charge permits the escape of gases but at the same time condenses any rising metal vapors. This cuts down losses (and sloppiness) caused by blowing.—ED.

Pro & Con: Shortage of Men?

Sir:

From my observations, the "bitter comment" of the professional engineer who signs himself "Superannuated" in the May issue (p. 167) is, sad to relate, more truth than exaggeration.

It is high time employers of engineers faced the facts!

HUGO KLEIN
Consulting Chemical Engineer
Altadena, Calif.

Sir:

The engineering profession has treated me kindly and rewardingly. Yet there is much truth in the remarks of "Superannuated."

I do not think there has even been a shortage of engineers in this country. All young people contemplating a career in engineering should listen to a lecture by "Superannuated." That would help them keep their feet on the ground after listening to the glorious description of their future in engineering as painted by some of industry's recruiting delegates.

The way of this profession is hard and seldom does one have a choice of jobs. The rewards will be in large measure the satisfaction of work in a field which a person must love—else there is little reward.

In short, engineering is just another job with just the usual future. Every youngster should give a level-headed and unemotional close scrutiny to its possibilities—and to his temperament—before choosing it.

JACKSON G. MERRIAM
Braintree 84, Mass.

Sir:

I read a letter from "Superannuated" in your May issue and I would like to add some comments of my own.

Since I believe there are two sides to every story, I think *Chemical Engineering* should investigate the engineer's side. Articles on the shortage of engineers based on information furnished by the Manpower Commission or EJC have appeared in many magazines. Everybody's on this bandwagon!

If you would interview engineers with 1, 2, 3, 5, 10, 20, and 40 years experience to get their side of the story, I think it would prove interesting—and revealing—reading. Give special emphasis to the so-called shortage, the work that engineers do, their relationships with management, how they compare with hourly paid workers, monetary returns, job satisfaction.

PETER W. ROGAR
Windsor, Conn.

Sir:

I don't agree with "Superannuated" that there is no shortage of chemical engineers in the U. S. I've recently talked to several dozen young fellows just graduating in chemical engineering this summer. Practically every one of them had anywhere from 4 to 19 acceptable job offers at least a month before graduation!

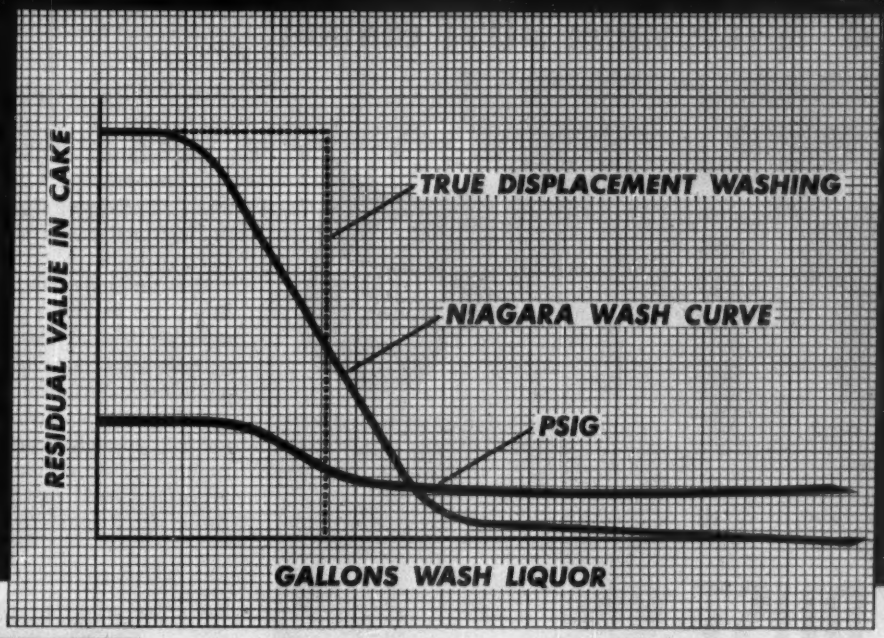
To state flatly "there is no shortage" is to see only half-truths and to be blind to evidence on the other side of the picture.

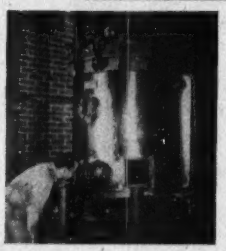
This, however, I do throw out for consideration: The shortage—or call it demand, if you wish—is largely concentrated among new graduates or very young engineers; there seems to be no particularly heavy demand for engineers with 5 or more years of experience . . . the demand decreases with age and years of experience.

JOHN S. STONE
Chicago 14, Ill.

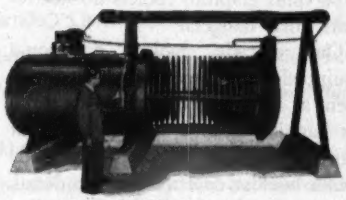
▶ *We'll agree that the argument "shortage vs. no-shortage" seems to be picking up momentum, with evidence piling up on both sides!*

One thing, though, becomes more evident: Many engineers refuse to accept the statement "There is an acute shortage" without definitive qualifications and sup-





FOR LIQUID CLARIFICATION Niagara Vertical Pressure-Leaf Filters are supplied in sizes handling up to 30,000 GPH. These filters are all-metal; leakproof; easily fabricated in stainless steel and other alloys; readily jacketed or lined to match your need.



FOR SOLIDS RECOVERY plus liquid clarification . . . Niagara Style "H" Pressure-Leaf Filters offer exceptionally fast removal of semi-dry cakes. Flow rates up to 45,000 GPH in one compact, leakproof unit.

if you wash your filter cake . . .

this WASHING CURVE is good news for you

The curve shows what happens typically when you wash residual solvent or other liquid from the cake in a Niagara Pressure-Leaf Filter.

Notice how close this is to true displacement washing. Here's what it means in results:

You can wash 10% acid in mother liquor down to .01%, using only three volumes of wash liquor per volume of cake to get this high acid recovery.

Another example is vegetable oil. You can reduce 10% by weight of oil in the cake to .01% by solvent washing.

You can save as much as 1½ hours per cycle over conventional washing (or air blowing) methods.

You can cut recovery costs decisively. Roughly 50% less steam is needed for evaporation of wash liquor, since dilution is roughly 50% less than with other filters.

You can eliminate the cost and upkeep of a separate filter used only for washing.

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SLY PIONEERS and LEADERS in INDUSTRIAL DUST CONTROL

Sly Unit Dust Filter at Rittman (O.) Plant. Hooded enclosures at dust source, connected by ducts to the Sly Dust Filter.

IF IT'S DUST IT'S SLY

If your processing involves dust, what the Morton Salt Co. has accomplished will be of interest to you.

Three years ago at one of its mills, this company had a serious dust problem — and installed a Sly Unit Filter. The equipment has proved entirely satisfactory in cleaning up the plant and improving its appearance.

Since then the Morton Salt Co. has made Sly installations at five other plants — not only Unit Filters but also the larger standard Filters including the Sly Dynaclone. These Filters are handling salt and similar dusts from conveying, screening, blending, and packaging operations.

In industries where collected dust is high in value, such as pigments, metallic and non-metallic minerals, Sly Dust Control not only cleans up the plant but also saves thousands of dollars yearly in value of collected dust.

Regardless of what you make, if you have a dust problem, our long experience in collecting all kinds of dusts can be of value to you in cleaning up the plant and effecting savings — *which frequently repay, in a relatively short time, the cost of the equipment.*

May we send you Bulletin 98, full of helpful information on dust control? *If it's DUST, it's SLY.*

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porting data. Perhaps industry should look upon this as a public relations challenge within its own house.—ED.

Idaho's First Triple Plant

Sir:

Am surprised at the statement in your June issue (p. 129) which states that J. R. Simplot Co. now becomes the first producer of triple superphosphate in Idaho.

It is my understanding that Gates Bros., Inc. has been producing triple super at Wendell, Idaho, since 1950 or early 1951. I remember that you published a flowsheet on the Gates operation and pointed out that it was the first privately-owned plant in this country to use a continuous process for making triple superphosphate. . . . Am I right?

LEE HANSEN

Salt Lake City, Utah

▶ *Yes, you are right. The Gates Bros. plant at Wendell, rated at 30,000 tons per year, was Idaho's first commercial producer of triple superphosphate. The continuous process used by Gates was described in our May, 1951 issue (pp. 208-211).*—ED.

Cascade Coolers With Hangers

Sir:

I was particularly interested in the article on Heat Exchangers in the May issue. But on p. 201 the statement was made that: "Pyrex cascade coolers require hangers which are not furnished by the manufacturer, standard impervious graphite coolers do not require such hangers."

Our cascade coolers do come equipped with hangers—in fact we sell them as a package unit which is ready for hanging from a ceiling, a wall or standing on the floor. Our cascade cooler booklet describes this in detail.

P. M. REYNOLDS

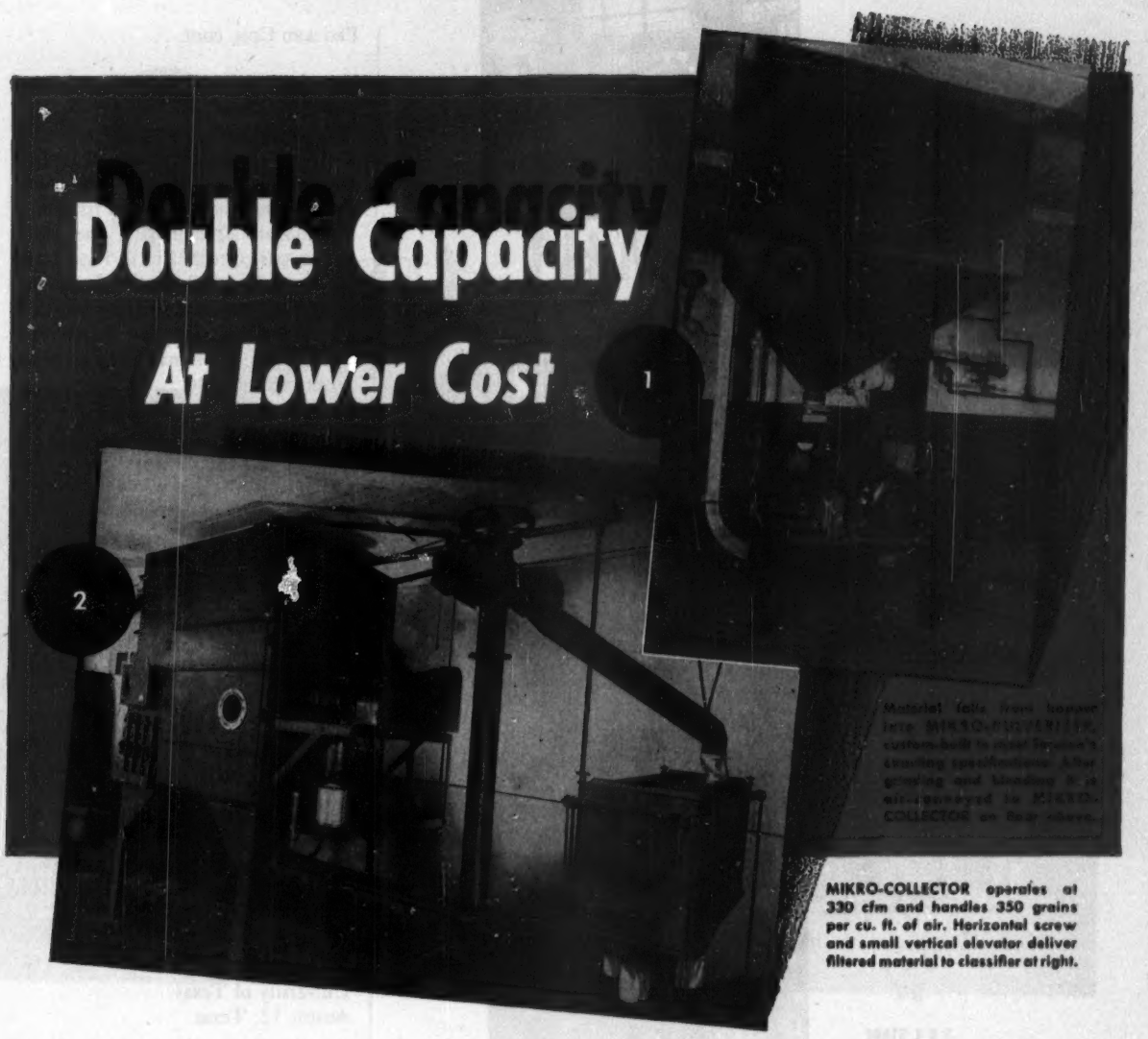
Advertising Manager
Technical Products Div.
Corning Glass Works
Corning, N. Y.

▶ *Reader Reynolds is perfectly right on that score.*—ED.

Rampant Primes

Those prime marks in C. A. Lee's article, "Design Hoppers for Use," on page 194 of our May issue, got away from us and ran rampant. Specifically, in Figs. 3 and 4, there should have

Double Capacity
At Lower Cost



MIKRO-COLLECTOR operates at 330 cfm and handles 350 grains per cu. ft. of air. Horizontal screw and small vertical elevator deliver filtered material to classifier at right.

MIKRO'S INTEGRATED SYSTEM has again proven itself to be both a money-saver and a time-saver in the combined functions of grinding, blending and dust control.

At the SERUTAN plant in Newark, N. J., this unified method (made possible by the incorporation of the MIKRO low pressure air conveying system) has out-moded batch handling by providing a continuous, automatic flow of material from a No. 2 DH MIKRO-PULVERIZER on one floor, to a MIKRO-COLLECTOR® on the floor above.

RESULTS:

100% increase in production . . . reduced cost due chiefly to elimination of batch handling . . . clean, dustless operation . . . improved working conditions . . . full product recovery . . . absolute protection of product against contamination.

This high-efficiency push-button operation steps up production by 100% for Serutan, but it can be engineered to meet almost any production quota on a wide variety of materials. It will pay you to investigate its possible application in your own plant set-up. Write now for information and descriptive literature.

*Patents Applied For by H. J. Hersey, Jr. and Pulverizing Machinery Company

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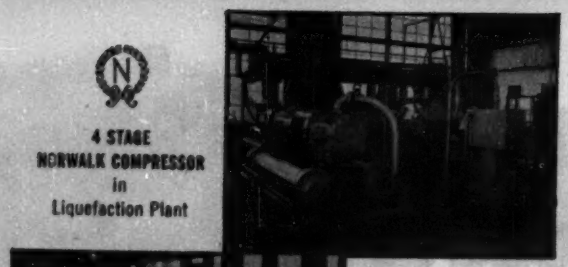

4 STAGE
NORWALK COMPRESSOR
in
Liquefaction Plant

4 STAGE
NORWALK COMPRESSOR
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Steel Plant

4 STAGE DUPLEX
NORWALK COMPRESSOR
in
Dry Ice Plant

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Every Norwalk Compressor is built to individual specifications from standard interchangeable parts, and is test-run for eight hours at the factory to assure efficient, trouble-free operation. Send for free descriptive catalog.

NORWALK COMPANY, INC.

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PRO AND CON, cont. . .

been both mu-prime's and mu's sans prime.

As the article pointed out correctly, μ' represents the coefficient of friction between material and wall. And where the drawings indicated such friction at a wall-material boundary, the designation was correct. But in Figs. 3 and 4 there were points at which the material was also shown sliding on itself, and here the designation should have been μ only—internal friction, hence no prime.—ED.

Standards for Cast Iron Pipe

Sir:

With reference to my article on cast iron pipe published in your June issue (p. 242), I have just learned from the American Standards Association that the tentative standards ASA A21.6 and A21.8 have now been approved as American Standard. The first is for cast iron pipe centrifugally cast in metal molds, and the second for cast iron pipe centrifugally cast in sand-lined molds.

I am telling you this in the event that some reader should question the present status of the Standards. At the time of the writing of the article, these were tentative standards and had not yet been issued.

HOWARD F. RASE

Dept. of Chemical Engineering
University of Texas
Austin 12, Texas

▶ *Author Rase points out that readers can now get copies of the Standards through the American Standards Association, 70 E. 45 St., New York 17.—ED.*

More on Submerged Combustion

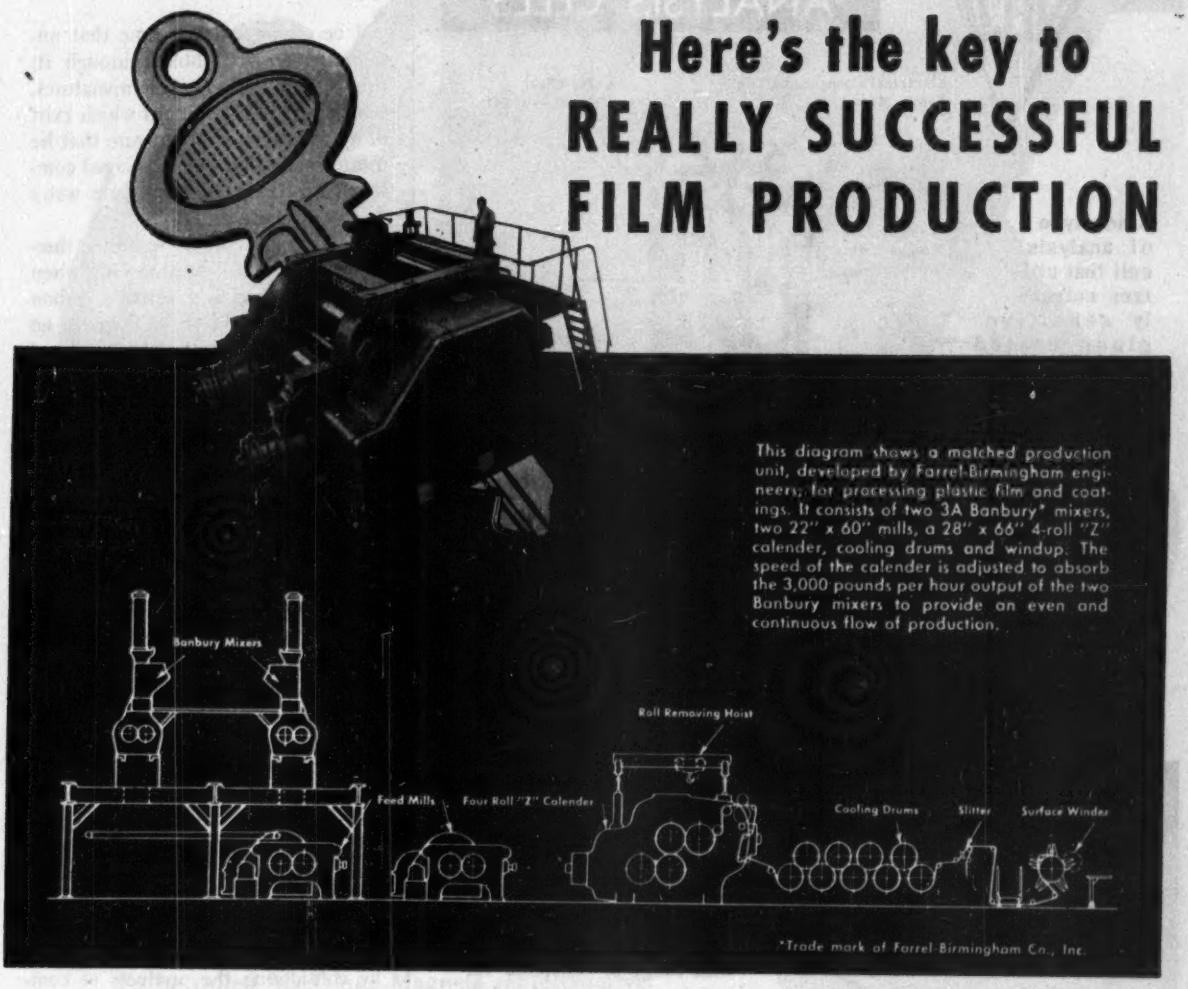
Sir:

I have just read Dr. Lindsey's report on Evaporation in your April issue; it is very interesting and informative.

I was pleased to see some space devoted to submerged combustion. The subject was covered quite well, but I find several slight inaccuracies. On p. 229 he states: "For example, pure water under atmospheric pressure will evaporate at around 90 deg. C. The thermal efficiency is around 95 percent, based on gross heating value of the fuel."

The first sentence of the statement is essentially correct; water will boil at around 90 deg. C. under submerged combustion conditions. Actually water

Here's the key to REALLY SUCCESSFUL FILM PRODUCTION



This diagram shows a matched production unit, developed by Farrel-Birmingham engineers, for processing plastic film and coatings. It consists of two 3A Banbury* mixers, two 22" x 60" mills, a 28" x 66" 4-roll "Z" calender, cooling drums and windup. The speed of the calender is adjusted to absorb the 3,000 pounds per hour output of the two Banbury mixers to provide an even and continuous flow of production.

*Trade mark of Farrel-Birmingham Co., Inc.

When Farrel-Birmingham developed the "Z" calender, production of plastic film took a giant step forward. The reason: *finer control of gauge.*

This machine, with its unique roll arrangement, positive roll positioning, flexible and extremely sensitive roll adjustment, and precise temperature control, has actually brought the production of calendered film and sheet to new levels of accuracy, quality, and speed.

Light, unsupported films are being commercially produced on the "Z" calender down to thicknesses of .002" and less, with gauge tolerances held within plus or minus .0001". Employing the crossed-axes device on the final pass, this accuracy can be maintained over a considerable range of light films.

Using this same device, comparable accuracy in the production of heavier films and sheet is possible over as wide a gauge range as .004" to .020".

Send for more information about this revolutionary development — the "Z" calender. Or, if you prefer, a Farrel-Birmingham engineer will be glad to discuss your film production problems with you.

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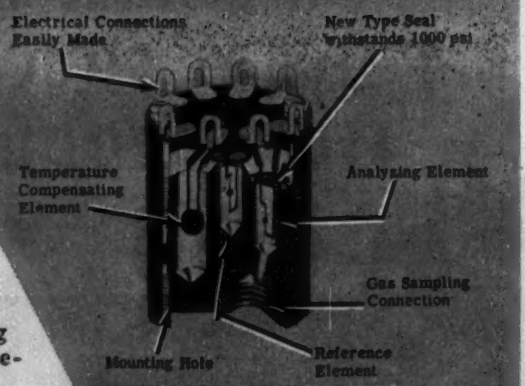

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Unaffected by corrosive gasses, liquids, and residues, which quickly throw old style open-wire elements out of calibration, these VECO CELLS are adaptable to a wide variety of uses, and combine simplicity of operation with a degree of efficiency heretofore unobtainable.

VECO ANALYSIS CELLS provide new efficiency for • instrumentation • gas analysis • combustion study — for • chemical research • hospital and college laboratories • food storage protection — cells designed and manufactured to your specific requirements.

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A request on your business letterhead will bring the
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VECO THERMISTORS are made and stocked in a wide range of resistance values - or can be produced in quantity to your exacting specifications.

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PRO AND CON, cont. . .

will be evaporated any time that unsaturated air is bubbled through it; this can be done at lower temperatures, similarly to the conditions which exist in a cooling tower. I am sure that he meant to say that the submerged combustion boiling point for pure water will be around 90 deg. C.

The second sentence regarding thermal efficiency will be true only when the gaseous fuel is essentially carbon monoxide. In this case there is no difference between the gross and net heating value of the fuel. Since natural gas would be the fuel used in most installations, it would seem logical to base statements of this sort on natural gases.

For practical purposes natural gas can be considered as essentially methane. According to Perry's "Chemical Engineers Handbook," third edition, the net heating value of methane is exactly 90 percent of the gross heating value. On combustion one pound of methane will yield 2.744 lb. of carbon dioxide, 13.275 lb. of nitrogen and 2.246 lb. of hydrogen. Also the one pound of methane will require 17.265 lb. of air for combustion. If the combustion air was supplied at 80 deg. F. saturated it would carry 0.02231 lb. of water vapor per pound of dry air, or a total of 0.384 of water vapor.

No great error will be introduced by considering the products of combustion as the same as air, and the water vapor from the combustion of the one pound of methane plus the water vapor introduced with the combustion air will total 0.164 lb. per pound of dry combustion products.

The temperature corresponding to this saturation humidity is 142 deg. F. (humidity figures from Industrial Research Service's "Psychrometric Tables and Charts" by Zimmerman and Lavine). Unless the products of combustion are discharged at some temperature below 142 deg. F. the difference between the gross and net heating value is not recoverable; thus only 90 percent of the gross heating value is available when evaporating water which boils at 90 deg. C. inasmuch as the combustion products are discharged at the same temperature as the boiling liquid.

The article also infers that the largest Submerged Combustion burner has a capacity of 5,000,000 Btu. per hr. Ozark-Mahoning Co. has built

A Spicy Story

Once upon a time a Milwaukee spice processor got fed up with replacing $18.00 screens ruined by tramp iron hurled through them by a spice mill.

So he called his Dings Magnets representative, who advised him to put a Dings Perma-Plate Magnet at the base of the hopper that fed the mill.

This powerful, non-electric Alnico magnet traps and holds tramp iron in its field until the mill is cleaned at the end of an operating cycle.

This is the way Dings Magnets can help processors of all kinds to protect equipment, produce a more pure product. *Write for free Catalog C-5000-B.*

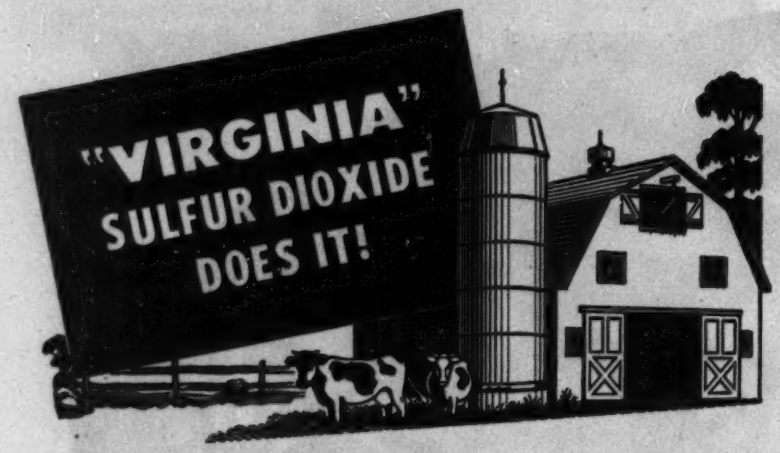
It's a powerful, non-electric Dings Perma-Plate. Perma-Plates are available in a complete range of sizes and three strengths. They're easily installed in chutes, ducts, over belts and elsewhere. They require no maintenance, have certified strength that's guaranteed forever.

Dings

DINGS MAGNETIC SEPARATOR CO.
4730 W. Electric Ave. • Milwaukee 46, Wisconsin

Magnetic Separation Leader for over Fifty Years

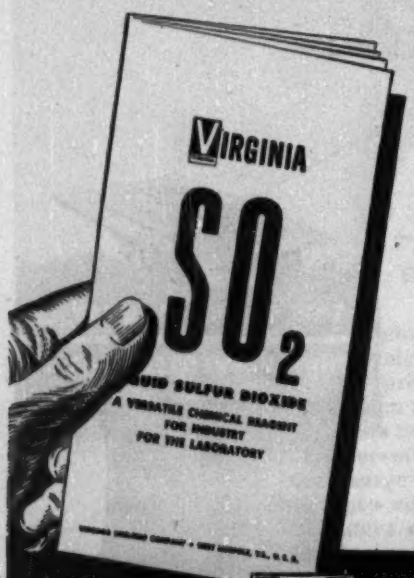
PP-353



Better grass silage—cheaper

Untreated grass silage is, of course, highly perishable; and though various methods of checking fermentation have been employed, each has had its own drawback—difficulty of application, ineffectiveness, high cost.

Use of liquid sulfur dioxide, begun experimentally in 1940 and established commercially in 1951 by Virginia Smelting Company, has proved a most satisfactory all-round solution to the problem. Under the trade name "Silagas," the company's SO_2 is now in use on hundreds of farms. It has been found to be 30% to 60% lower in cost than any method previously employed—and successful in preserving a high proportion of proteins, organic nutrients and carotene that were lost in earlier ensiling processes.



Could SO_2 help you?

For three decades "Virginia" has been continuously working to make its SO_2 more useful to industry. To date, the versatile chemical has found a place in the operations of more than 40 different industries, as a reducing, neutralizing and bleaching agent, preservative and antichlor, and for pH control. Perhaps "Virginia" chemists could point out ways in which SO_2 would be helpful to you. They'd be glad to look into the possibilities, and without obligation. As a first step, why not send for our folder on "Virginia" SO_2.

VIRGINIA SMELTING COMPANY
Box 21, West Norfolk, Virginia

Field Offices:
NEW YORK
BOSTON
DETROIT
CHICAGO
ATLANTA

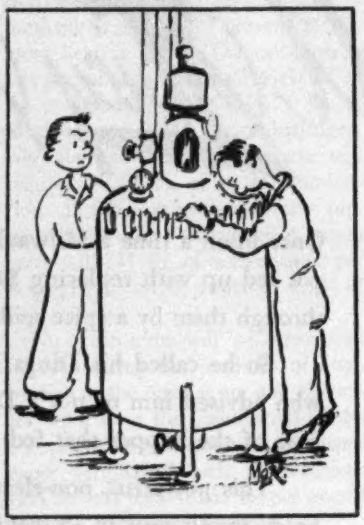
VIRGINIA Chemicals

burners which are in commercial operation with capacities up to 24,000,000 Btu. per hr.

WM. I. WEISMAN
Chemical Engineer
Ozark-Mahoning Co.
Tulsa, Okla.

▶ *We appreciate this additional engineering information on submerged combustion, and we're glad to pass it along to all our readers interested in that steadily growing field.*—ED.

We welcome pertinent, informative letters from our readers everywhere; we invite you to send in your opinions on significant developments and trends in chemical engineering and in the chemical process industries. Address the Editor, *Chemical Engineering*, 330 West 42nd St., New York 36.



——LITTLE BONER——

Double Trouble

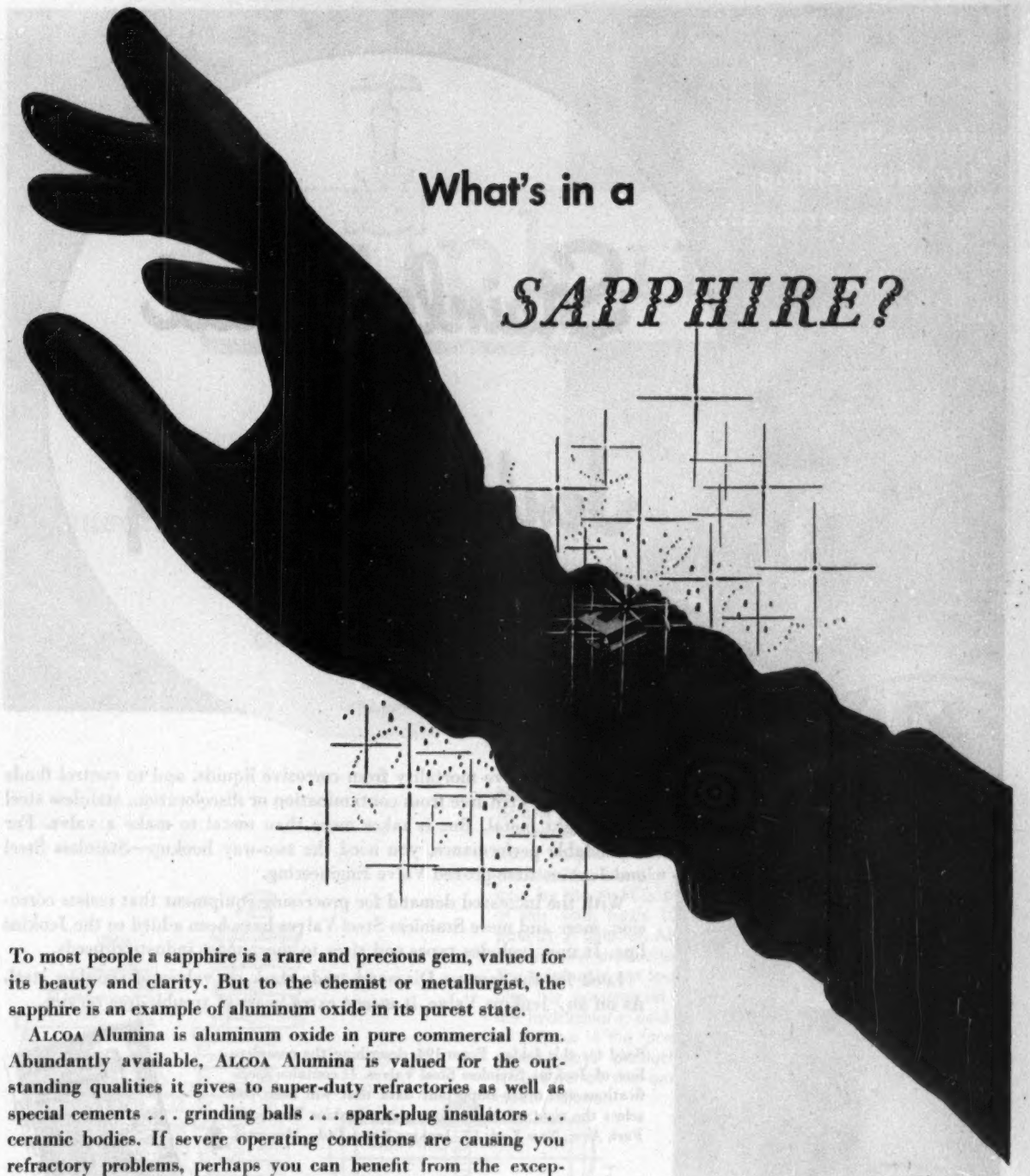
After a few successful runs of a dye intermediate in pilot equipment it was decided to move on to a large scale. The work was being done by a youngster of more than usual thoroughness, and the boss merely said: "Use the larger tank and double up on everything."

But the resulting product bore little resemblance to previous runs; in fact, it didn't resemble much of anything.

"You didn't forget to double something, did you?" asked the boss.

"No," answered the young expert, "I doubled the raw material, the volume—and the temperature."

Do you know of a true "little boner" that can hold its own against the one you've just read? If so, why not send it to the Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.



What's in a *SAPPHIRE?*

To most people a sapphire is a rare and precious gem, valued for its beauty and clarity. But to the chemist or metallurgist, the sapphire is an example of aluminum oxide in its purest state.

ALCOA Alumina is aluminum oxide in pure commercial form. Abundantly available, ALCOA Alumina is valued for the outstanding qualities it gives to super-duty refractories as well as special cements . . . grinding balls . . . spark-plug insulators . . . ceramic bodies. If severe operating conditions are causing you refractory problems, perhaps you can benefit from the exceptional perfo.mance record of ALCOA Alumina.

Refractories fortified with ALCOA Alumina help operators increase the output of metallurgical furnaces, chemical-processing kilns, glass tanks and high temperature equipment. Higher operating temperatures can be sustained over longer periods . . . downtime is reduced.

We have considerable data concerning the value of ALCOA Alumina in ceramics. Some of this information may be of interest to you. Let us discuss it with you.

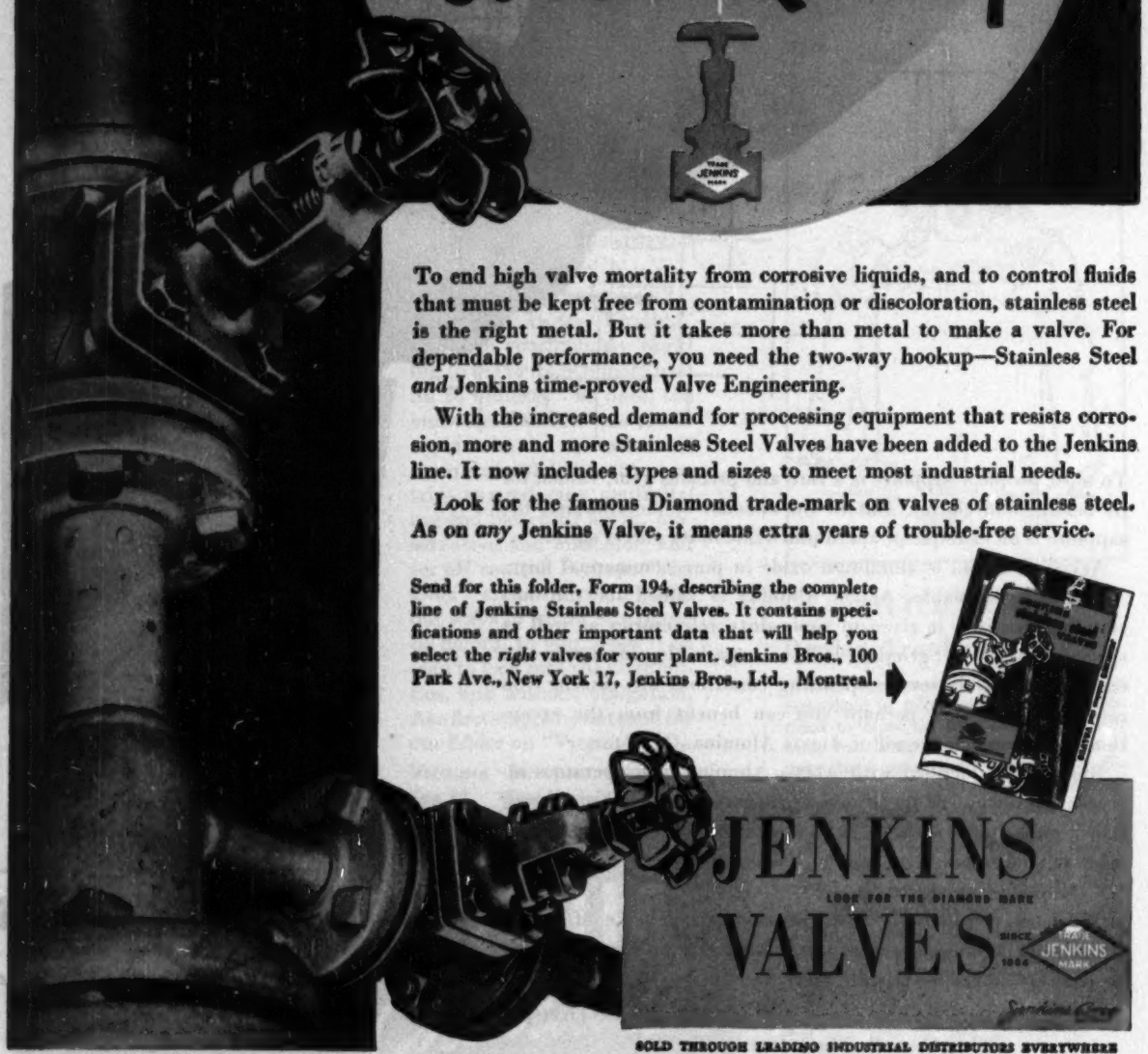
Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION
702-H Alcoa Building, Pittsburgh 19, Pa.

Alcoa Chemicals

ALUMINUM COMPANY OF AMERICA

Here's the hookup
for valve-killing
corrosive services...

Stainless Steel
PLUS
Jenkins Quality



To end high valve mortality from corrosive liquids, and to control fluids that must be kept free from contamination or discoloration, stainless steel is the right metal. But it takes more than metal to make a valve. For dependable performance, you need the two-way hookup—Stainless Steel *and* Jenkins time-proved Valve Engineering.

With the increased demand for processing equipment that resists corrosion, more and more Stainless Steel Valves have been added to the Jenkins line. It now includes types and sizes to meet most industrial needs.

Look for the famous Diamond trade-mark on valves of stainless steel. As on *any* Jenkins Valve, it means extra years of trouble-free service.

Send for this folder, Form 194, describing the complete line of Jenkins Stainless Steel Valves. It contains specifications and other important data that will help you select the *right* valves for your plant. Jenkins Bros., 100 Park Ave., New York 17, Jenkins Bros., Ltd., Montreal.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

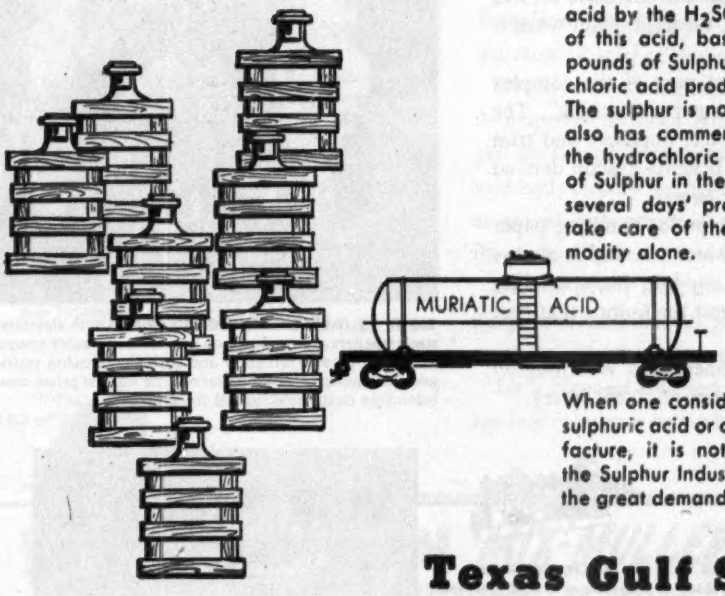
Sulphur

Loading a ship with Sulphur at Galveston

Thousands of tons mined daily, but where does it all go?

PARAPHRASING an old saying: 'It takes a chemical to make a chemical,' certainly applies to hydrochloric acid.

No chemical engineer has to be told how hydrochloric acid is made but sometimes with the mind focussed on the word "hydrochloric" little thought is given to another word "sulphuric." It is this word that calls attention to the fact that to make one net ton of 20° Bé hydrochloric acid by the H_2SO_4 process requires about 950 pounds of this acid, basis 100%, which is equivalent to 320 pounds of Sulphur. About one third of the annual hydrochloric acid production is made by the use of sulphuric. The sulphur is not lost because salt cake, a by-product, also has commercial value. But any way you figure it, the hydrochloric acid industry is an important consumer of Sulphur in the form of sulphuric acid. In fact, it takes several days' production from all the Sulphur mines to take care of the annual production of this one commodity alone.

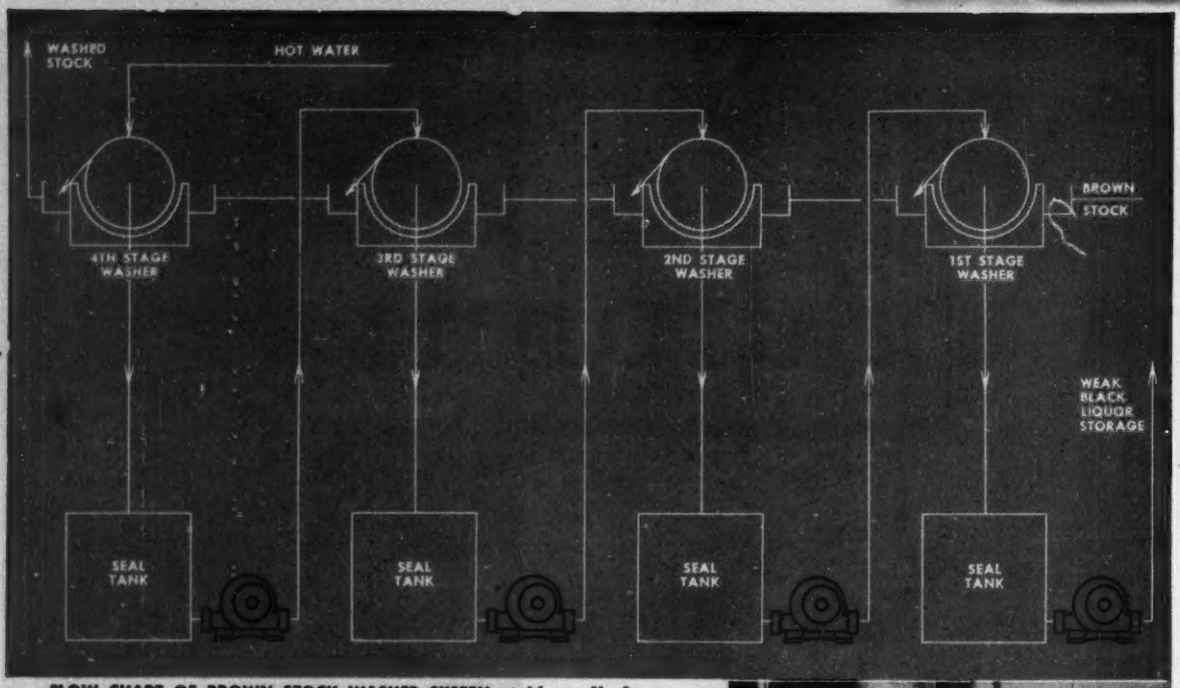


When one considers all the other chemicals that require sulphuric acid or other Sulphur compounds for their manufacture, it is not difficult to appreciate how faithfully the Sulphur Industry is serving industry today in spite of the great demands made upon it.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas



FLOW CHART OF BROWN STOCK WASHER SYSTEM at Macon Kraft Company, Macon, Georgia, where Worthington pumps circulate weak black liquor in a counter-flow system.

How Macon Kraft got "The right pump for the job"

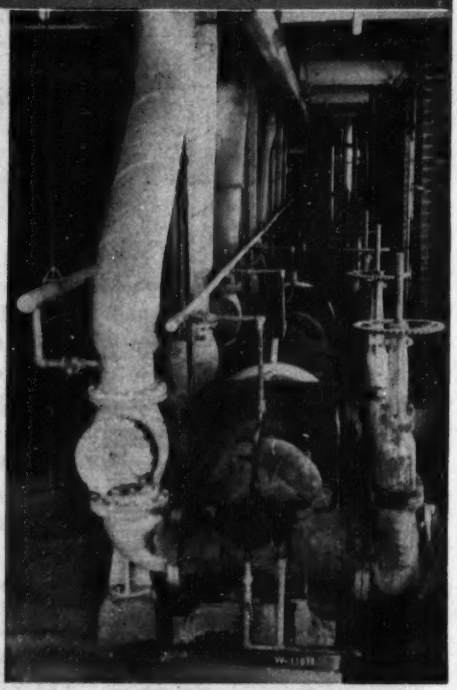
Flow chart shows how Worthington pumps with stainless impellers and trim fit into washing phase in brown stock system

Over 100 Worthington pumps were selected for corrosive-erosive services in Macon Kraft Company's Macon, Georgia, plant when it was built in 1948.

The pumps were to become an important part of the complex system which included "the world's longest paper machine". The selection of the eight pumps with stainless-steel impellers and trim (see above chart) is but *one* example of the benefits Macon derived by choosing from *the world's broadest line of pumps.*

Worthington makes different types of pumps for handling paper stock, green liquor, black liquor and white water . . . and is always prepared to recommend the correct unit for *any* job. Our specialists will be glad to study your situation and suggest the pumps that best suit your system's requirements.

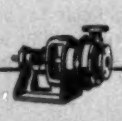
Write, stating details and specific requirements, to Worthington Corporation, Centrifugal Pump Division, Harrison, New Jersey.



EIGHT 12-INCH WORTHINGTON PUMPS with stainless-steel impellers and trim used on brown stock washer system at Macon plant. Durability and corrosion-erosion resistance for uninterrupted long service life was the prime consideration in the selection of these pumps.

C.3.2

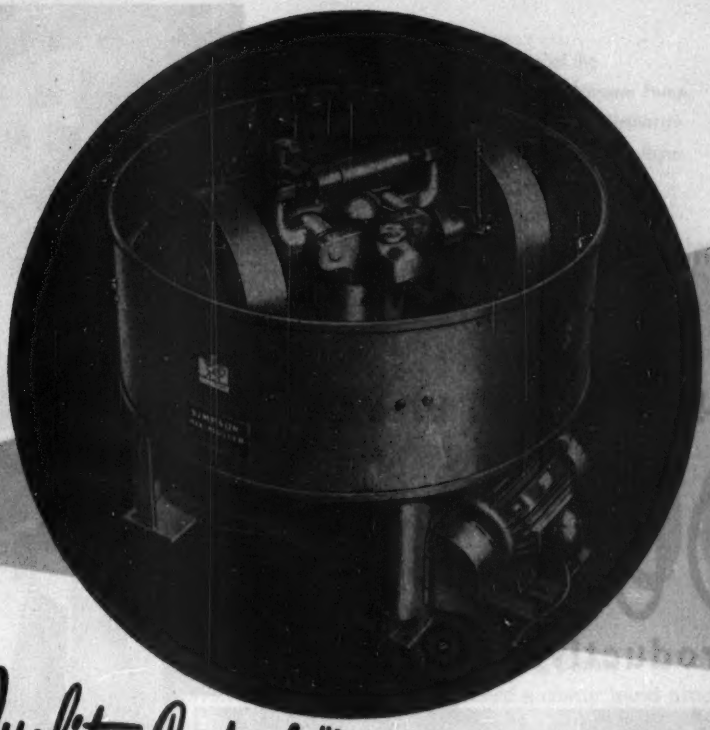
CENTRIFUGAL STOCK PUMPS
Type FP. Handle all kinds of stock up to 6½% consistency. 6 sizes. Capacities up to 6000 gpm; heads up to 160 ft.



GENERAL PURPOSE PUMPS
Type CN. Single stage. Sizes ¾ in. to 6 in. Capacities up to 2400 gpm; heads to 390 ft.

BOILER FEED PUMPS
Capacities up to 2000 gpm; pressures to 1250 psi.

WORTHINGTON
Centrifugal Pumps



Rx: to relieve Quality Control "headaches"...
BLEND MATERIALS IN SIMPSON MIX-MULLERS!

MULLING GIVES YOU POSITIVE CONTROLLED RESULTS

Watch the practiced technique of a chemist's mortar and pestle—the intensive rubbing and smearing actions—and basically, THAT'S MULLING!

Mulling with a SIMPSON Mix-Muller utilizes a special pair of revolving mullers and plows mounted on a stationary pan. The mullers are adjustable and are supported by rocker arms. This leaves them free to ride on the material, creating a true mulling action as they revolve. The results are thorough, more rapid blending.

IF you are having quality control "headaches," it will pay you to take a good close look at your *mixing* operations. Experience has shown that improperly mixed materials can often be the cause of inferior end-products or processes.

The type of mixing equipment you use is, of course, the secret to properly controlled mixing. When you use Simpson Mix-Mullers, you are assured of complete control at all stages of mixing . . . with uniformly blended batches that will be the same—day in, day out—as proved by hundreds of successful applications throughout the chemical process, food and ceramic industries.

Built in twelve basic models, in capacities from 1/10 to 60 cu. ft., Simpson Mix-Mullers all give you the time-tested mulling principle of controlled mixing, with emphasis on improved quality at lower mixing cost.

Let a National Engineer show you how these versatile Mix-Mullers can help solve your particular mixing problems. Write for details.

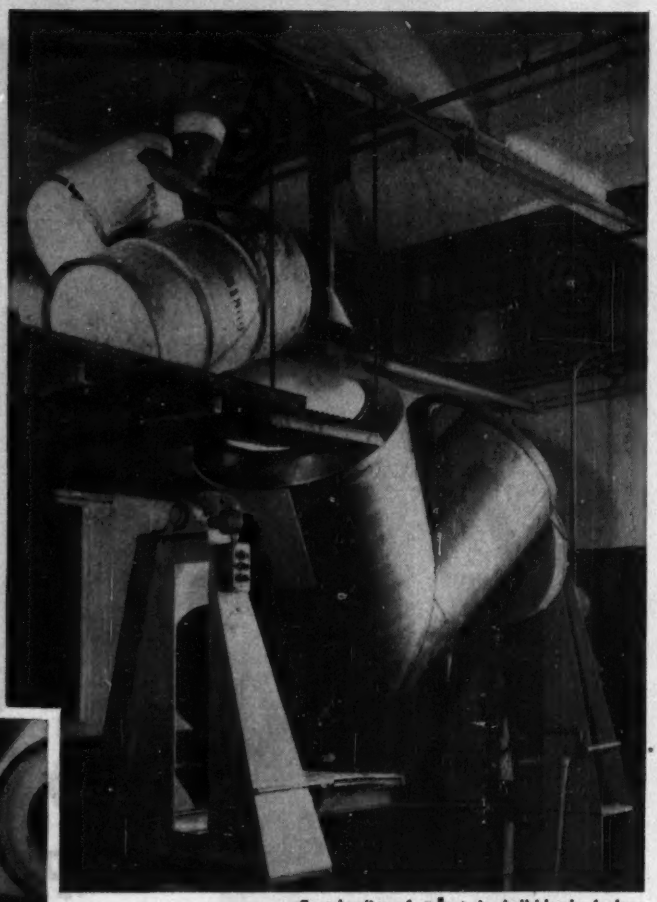
SIMPSON *MIX-MULLER*® DIVISION

NATIONAL ENGINEERING CO., 604 Machinery Hall Bldg., Chicago 6, Ill.

(Not Inc.)

The Wm. S. Merrell Company says:

"p-k twin shell blender DOUBLED productive capacity"



Easy loading of p-k twin shell blender is done from special elevated loading platform.

Technician at the Wm. S. Merrell Company, Cincinnati pharmaceutical manufacturer, unloads compound from a p-k twin shell blender. Shown is unique dust collecting nozzle, used to draw dust into piping to outside air-filtering plant.

"The p-k twin shell blender not only doubled our productive capacity, but also further assured us of a complete mixing and blending process. This is essential to provide uniformly accurate dosages of all Merrell pharmaceuticals," states Mr. Frank J. Messmann, Director of Production and Purchasing of The Wm. S. Merrell Company, Cincinnati.

Keeping Merrell pharmaceuticals absolutely free of contamination is a major requirement, successfully met by a p-k twin shell blender with a special dust control collection system. The unique dust control system draws dust through pipes to an air-filtering plant outside the main building.

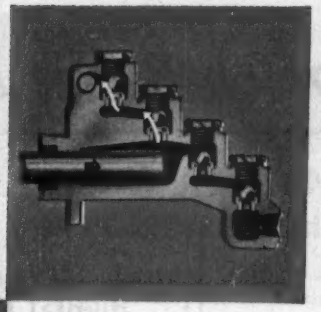
p-k twin shell dry blenders are fast and thorough, provide critically uniform blending along with quick cleaning. Because p-k manufactures many kinds of blenders — ribbon, double cone or the twin shell—you can be assured of the right blender for your needs. Write now for Catalog No. 12 giving complete engineering data or send samples of materials for analysis of blending.

the Patterson-Kelley Co., inc.

180 Lackawanna Ave., East Stroudsburg, Penn.

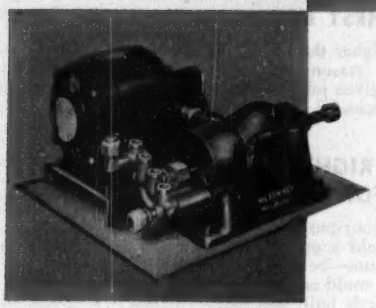
1924

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities



——the discharge stroke of the Milton Roy Controlled Volume Pump. Forward thrust of plunger lifts discharge double ball-checks and displaces metered quantity of liquid. Suction ball-checks are positively seated.

Sloping passages and absence of pockets assure discharge of entrained air, to maintain high and reproducible volumetric efficiency.



Fifty Per Cent Time Savings with this Milton Roy Pump

CONTROLLED VOLUME PUMPING

INSTRUMENTATION

PROCESS CONTROL SYSTEMS

BLENDING AND FORMULATING

On The Job in an Eastern manufacturing plant, this Milton Roy "miniPump" replaced a costly hand process, wherein *one tenth of a milliliter* of liquid was added to open cells on each stroke of the pump. The switch to automatic continuous injection with this pump cut production time in half, gave much greater accuracy.

Such efficiency in the precise metering of minute quantities of any clear liquid is merely one reason why "miniPump" is so widely used in industry. This pump has application in laboratories . . . in pilot plants . . . for full-scale production operations . . . in instrumentation, continuous processing. As air-powered or motor-driven units, they operate within the capacity range of 3 to 3,200 milliliters per *hour*, against pressures to 1,000 pounds per square inch. Accuracy is maintained within 1%.

This precision instrument is the miniature member of the family of Milton Roy Controlled Volume Pumps which range in capacity up to 45 gallons per minute, against pressures up to 25,000 pounds per square inch. They are available as single or multiple units, or as component parts of complete chemical feed and control systems.

***Bulletin No. 653** describes "miniPump", its design, construction, uses. Write **today** for your **free** copy.*

Engineering Representatives in the United States, Canada, Mexico, Europe, Asia, South America and Africa.

Roy COMPANY

Manufacturing Engineers 1222 E. MERMAID LANE • PHILA. 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

"Buffalo" Tips on Better Pumping

5 WAYS to Get the Most From Your PUMPING INVESTMENT

1. MATCH THE PUMP TO THE CONDITIONS

First, determine all possible conditions of the liquid to be pumped—chemical analysis, suction lift (if any), head or pressure, specific gravity and temperature of liquid—then pick the exact pump made for those conditions. (In the "Buffalo" line, you'll *find* that "ideal" pump because the line is so complete.)

2. SAVE ON FIRST COST BY USING HIGHEST RECOMMENDED DRIVER SPEED

The higher the speed, the more the pump will deliver—within reason—and the smaller the pump you can use for a given job. But be sure to operate at no higher than recommended speeds. Overspeeding wears out any pump.

3. RIGHT INSTALLATION AIDS PERFORMANCE

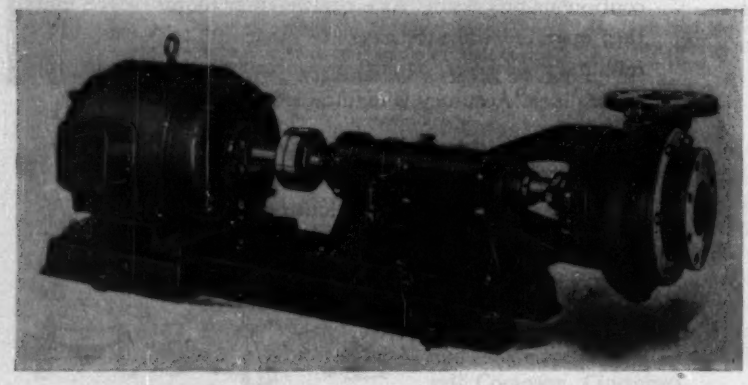
Give your pump the best chance—install close as possible to liquid supply source—keep pipe friction losses to a minimum—be sure suction line has no humps or hollows which could cause air locks. (You'll find "Buffalo" Pumps compactly built and easy to install)

4. REGULAR MAINTENANCE SCHEDULE LENGTHENS PUMP LIFE

Regular inspections and servicing of bearing lubrication, shaft alignment, packing and impeller, not only keep your pumps running smoothly, but head off minor conditions which could develop into problems later on. (You have a long-life "bonus" to start with if your pumps are "Buffalo"!)

5. A QUALITY PUMP IS ALWAYS AN ECONOMY—SPECIFY "BUFFALO"

No installation can be better than its pump. For known quality that means long life, efficient performance and simple maintenance, pick the pumps used in many of the country's largest installations — "Buffalo" Pumps.



"Buffalo" Full Ball Bearing Pumps For Alloy Construction are among a wide selection for the chemical industries. May be had in iron, bronze, stainless steel, Hastelloy "B" and "C" or nickel. 5 to 900 gpm for heads up to 160'. *Write for Bulletin 982.*

BUFFALO "Buffalo" PUMPS, INC.

501 BROADWAY BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Ever ask your **TREASURER . . .**

WHAT *HE* THINKS OF YOUR TANKS?

(A POSEY IRON Bid Might Interest Him and YOU)

Most treasurers are apt to put cost first. And cost is certainly *not* the only factor to consider when buying steel plate construction.

But—

It's good engineering as well as good financial policy to refuse to pay a penny more for tanks . . . or pressure vessels . . . or stacks . . . than is necessary fully to meet *the standard desired.*

The Posey Iron Works offers you 42 years of money-saving experience over the full range of steel plate fabrication . . . *practical* engineering and design service that concentrates on structural integrity and safety rather than on cost-padding "frills".

That's why we say a Posey Iron bid might interest your treasurer as well as you.

Edges of Plates Properly Prepared for Welding . . .
Electrodes Carefully Selected

Perhaps more than any other production step, welding influences tank costs and structural soundness. Every electric welder in Posey's shops is fully qualified. No plate is welded without proper preparation of edges . . . electrodes are chosen after careful consideration of requirements.

Posey meets all standard codes including ASME; API-ASME; API. Consultation does not obligate you.

Posey Iron Works self-supporting stacks installed at the Niagara Falls Plant of the International Graphite & Electrode Division of Speer Carbon Co. Height: 50 ft. Diameter: 3 ft.

POSEY IRON WORKS, INC.

Steel Plate Division

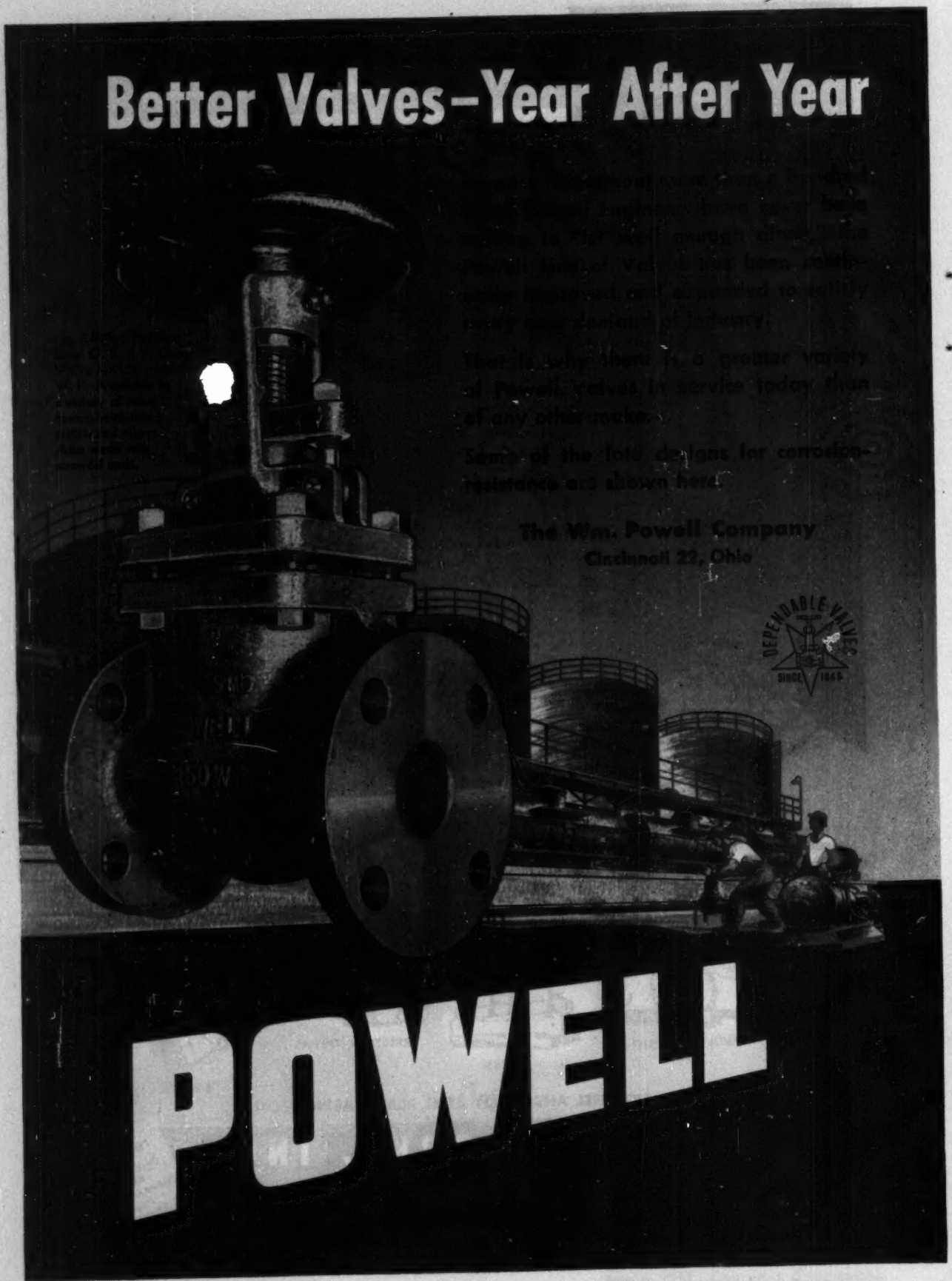
LANCASTER, PA.

New York Office: Graybar Building

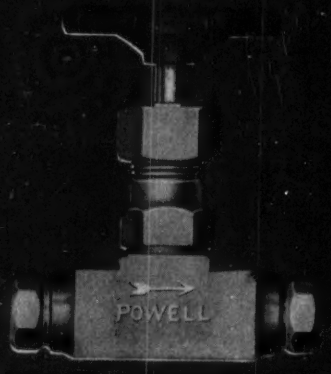
ESTABLISHED SINCE 1910

DIVISIONS
Brick, Machinery
Foundry
Industrial Heating
Irrigation
Shipbuilding
Steel Plate

Better Valves–Year After Year



The Wm. Powell Company
Cincinnati 22, Ohio



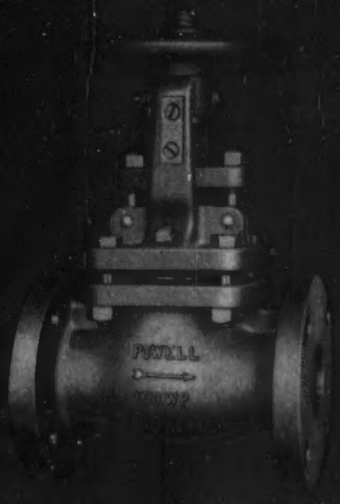


Fig. 1832—200-pound Stainless Steel Gate Valve with screwed-in bonnet and inside screw rising stem. Available in other corrosion-resisting metals and alloys. Also made with flanged ends.

Fig. 1878—Aluminum Globe Valve for 100 pounds W.P. Has union bonnet, stainless steel stem and composition disc. Also available with flanged ends.

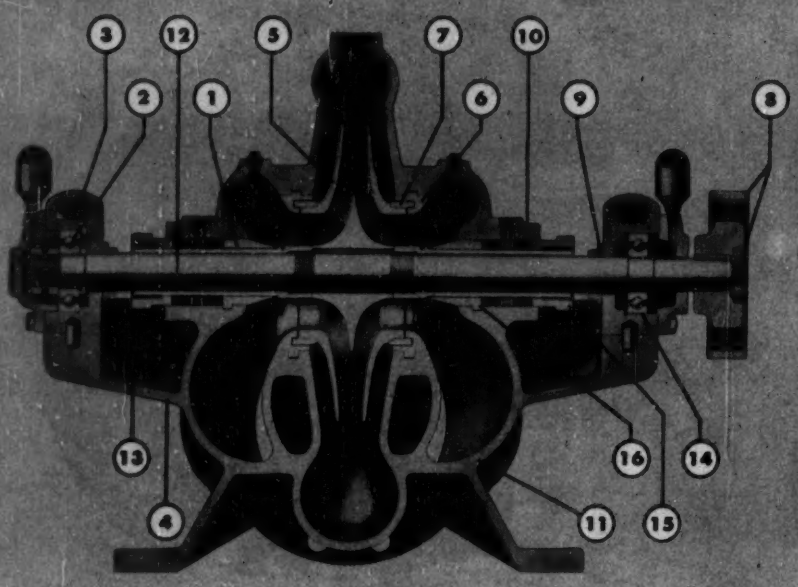
Fig. 2342—Stainless Steel Swing Check Valve for 150 pounds W.P. at 500F. Also made for 300 and 600 pounds W.P. at 800F. Available in other corrosion-resisting metals and alloys. Also furnished with screwed ends.

VALVES

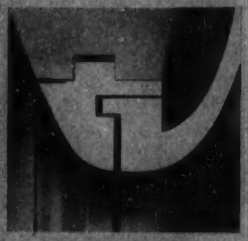
IN BRONZE, IRON, STEEL AND CORROSION-RESISTING METALS AND ALLOYS

DE LAVAL
SINGLE STAGE CENTRIFUGAL PUMPS

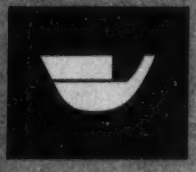
for dependable industrial service



Labyrinth wearing rings minimize leakage...maintain high efficiencies



Labyrinth rings used in these De Laval pumps retard flow of water through labyrinth passage.



Flat rings showing relatively unimpeded flow of water.

(1) **Shaft Sleeves** are screwed on, to abut the impeller and make a water-tight joint. Sleeve expands freely and independently of shaft when temperatures change. There is no tendency to buckle.

(2) **Thrust Bearing** locates rotor axially.

(3) **Bearing Caps** easily removable for maintenance.

(4) **Bearing Brackets** scraped to lining bars for perfect alignment.

(5) **Impeller** hydraulically balanced, finished on all surfaces.

(6) **Labyrinth Wearing Rings** held accurately in machined grooves in both case and cover.

(7) **Impeller Wearing Rings** threaded on impeller, opposite to rotation.

(8) **Flexible Coupling** ground on all exposed surfaces and statically balanced, complete coupling supplied, pump half mounted on taper so that it can be easily removed. Check nut locks coupling on taper.

(9) **Deflector** keeps water out of bearing.

(10) **Stuffing Boxes** extra deep; lantern rings for water sealing.

(11) **Pump Case** horizontally split; machined to limit gages.

(12) **Steel Shaft** ground to limit gages.

(13) **Drip Boxes** large; provided with drain openings.

(14) **Radial Bearing** free to move axially, thus avoiding temperature strains.

(15) **Glands** split horizontally.

(16) **Protecting Bushings** renewable.

You can count on the performance of the De Laval Single Stage Centrifugal Pumps because they are precision-made to high manufacturing standards and incorporate the many quality design features shown in the cross-section.

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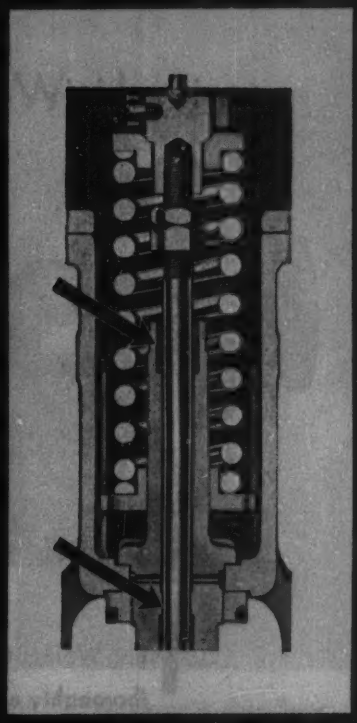

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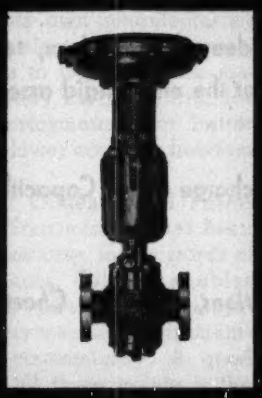

The two-point guiding of the upper stem in the Honeywell Series 700 Valve eliminates side thrust by supporting the stem at top and bottom in continuously lubricated bearings assuring practically frictionless response to the slightest changes in signal air pressure. The Honeywell Series 700 wide band proportional valve comes in a full range of styles and sizes has *all* the features you look for in a fine valve. Write today for your copy of Bulletin 700-2.

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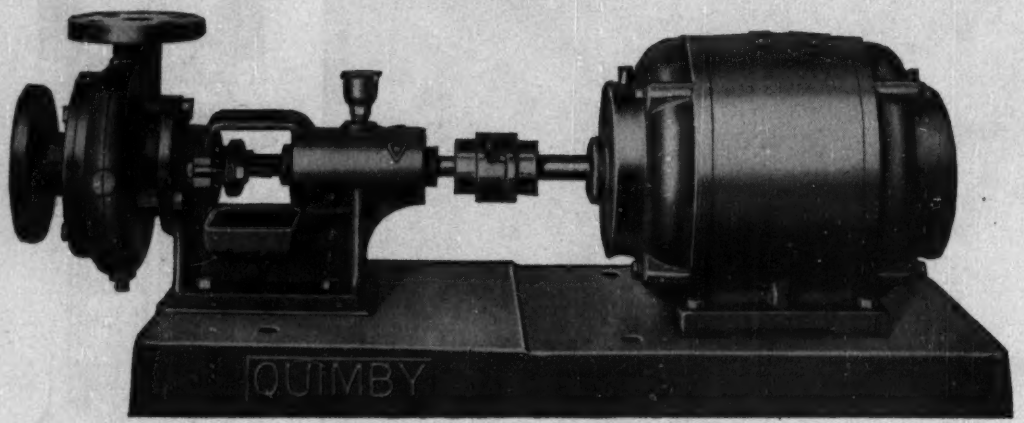

This Warren-Quimby Pump is designed to give both dependable and thoroughly economical satisfaction in process industries and chemical plants having semi-critical requirements. It has proven its merit conclusively whenever correctly applied.

Simplicity of design, sturdy bearings, extra deep stuffing box, tapped catchall, together with strong construction throughout the entire rigid assembly, all contribute to long, useful life at moderate cost.

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CG-4

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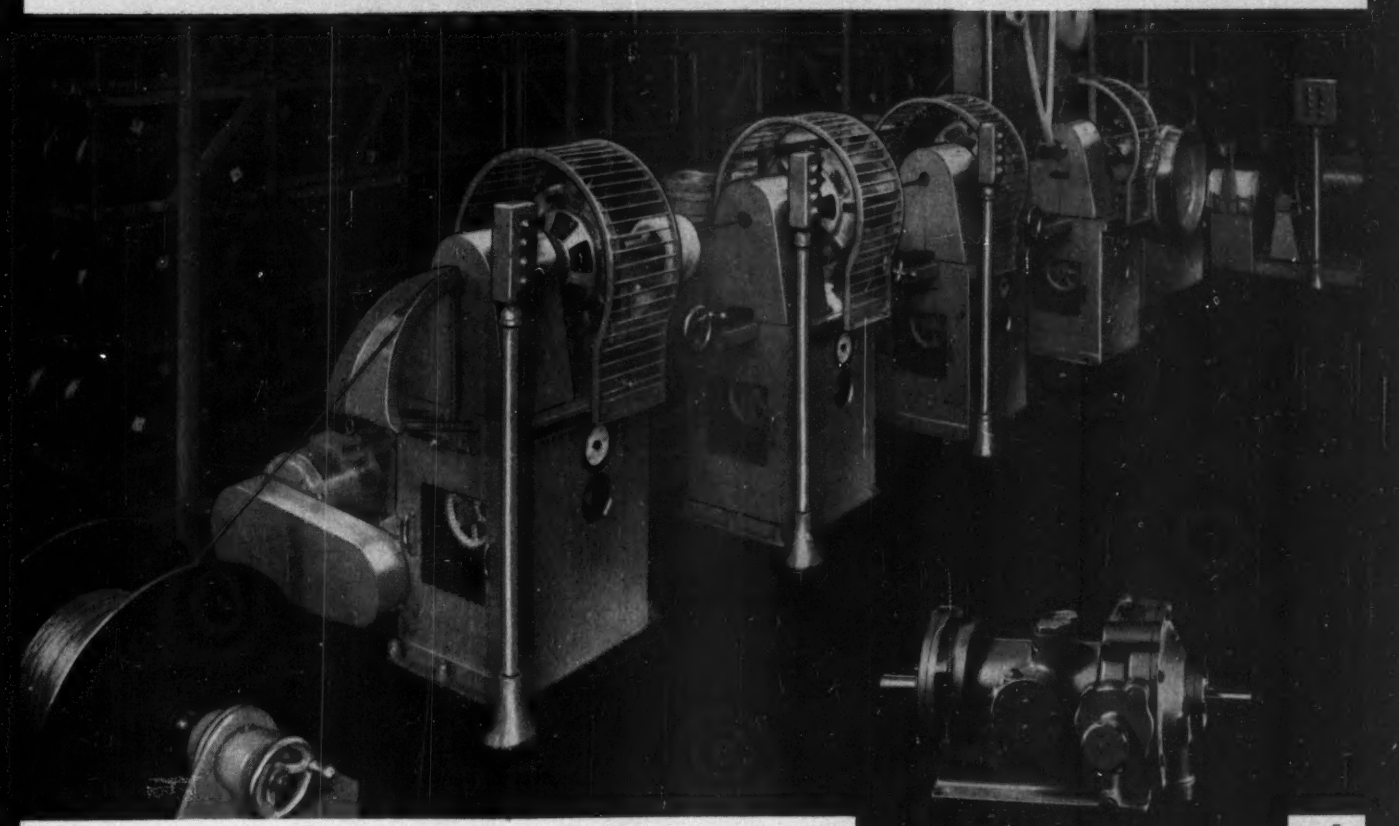


Its use of Oilgear Fluid Power

Western Electric Company, manufacturing unit of the Bell Telephone System, originates, designs and builds many of the special machines it uses in its own manufacturing processes. It also maintains unceasing pressure to improve upon machines already in operation, for optimum performance, for better product, for lower costs, for freedom from trouble.

Its use of Oilgear Fluid Power Drives and Transmissions has been increasing because, in the words of their engineers, Oilgear enables them among other things to synchronize many machine components easily and economically. A good example of all these points is the "short haul" video cable wrapping machine pictured above.

This machine was designed and built by the company's own men some years ago. For optimum performance, the speed of the heads should be easily and independently variable and the direction of rotation instantly changeable because the lay and pitch of the wrappings must be varied according to the requirements of the run. Moreover, the inside contour of the tube formed by the wrapping should be smooth and uniform so as to avoid setting up echo waves that interfere with transmission and vitiate signal strength.

Because of these requirements, a new drive was installed something over 4 years ago. A line shaft drives five Oilgear Fluid Power Transmissions, one at each machine head and the capstan.

The results were these: uniformity and control of tension are so good, the machine runs at 4 times its former machine speed; it is easy to vary speed and direction of rotation of each individual head; eccentric heads gave way to concentric heads, and supply spools are now loaded to full capacity instead of ¼th to ⅛th as before; the machine is stopped less frequently for loading. Maintenance on the former drive was involved and frequent—on the Oilgear equipment it has been simple and negligible.

There is some reason to suspect that Oilgear Fluid Power with its wide range of advantages may solve some of *your* machine design problems and make the results very pleasing and profitable. Why don't you really find out? THE OILGEAR COMPANY, 1579 West Pierce Street, Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR

for your information...

brief summaries of helpful product news

USE OF SYNTHETIC RESIN ADHESIVES RISES SHARPLY

In addition to their use as label adhesives for packages shown here, synthetic resins also are used in the manufacture of boxes, bags, books and shoes.

Synthetic resin-based adhesives are finding sharply increased usage by the packaging industry because of their superior properties, adaptability to high-speed machinery, stability and convenience. The resin being used in largest quantity is polyvinyl acetate.

Monsanto is a major supplier of plasticizers used in polyvinyl acetate to impart grease resistance, flexibility, required tackiness, stability and other desirable performance and processing properties. Other synthetic resins now being used in greater amounts by this industry, and for which Monsanto supplies plasticizers, are polyvinyl chloride, zein, casein, acrylates, polystyrene and the cellulosics.

Because of the current interest in these resins, Monsanto has recently issued a technical bulletin which makes available typical formulations of the major synthetic resin adhesives: emulsion, hot-melt, delayed-tack, solvent pressure-sensitive and adhesive primers or coatings.

The bulletin discusses the properties and uses of the various adhesive formulations, and includes a table which evaluates Monsanto plasticizers in polyvinyl acetate formulations. Three Monsanto plasticizers have been approved as nontoxic by the Bureau of Animal Industry and the Food and Drug Administration.

Synthetic resins are being used in the greatest quantity by the packaging industry as label adhesives. Delayed-tack formulations permit bottle-labeling machinery to operate at the rate of 300 bottles per minute instead of 40 to 60 bottles per minute with other adhesives.

In addition to their use as label adhesives, the synthetic resin-based products are employed in the manufacture of packages, boxes and bags, as well as books and shoes.

For a copy of the bulletin, check the coupon.

New Bulletin Offered On Chlorosulfonic Acid

Useful information about the properties, reactions and applications of chlorosulfonic acid has been compiled in bulletin form by the Organic Chemicals Division of of Monsanto Chemical Company.

The 12-page bulletin reviews typical reactions of chlorosulfonic acid with inorganic and organic compounds.

Chlorosulfonic acid has advantages over sulfuric acid as a sulfating or sulfonating agent, the bulletin points out, because free hydrochloric acid gas is formed instead of water, thus avoiding the problem of spent acid. The evolution of hydrochloric acid gas is also an indication of reaction progress.

In addition to chemical and physical properties, the bulletin includes a section on proper storage and safe handling.

In this section there is a discussion of personal protective equipment, first aid treatment and other important topics.

To get your copy of this informative bulletin send in the coupon today.

Parathion Safety Poster Available from Monsanto

Monsanto's widely circulated poster on the safe handling of parathion is now available in Spanish or Portugese translations, in addition to English, for use by formulators.

This poster, entitled "Handle Parathion Safely," is helpful to anyone who applies or handles Monsanto parathion. It is being offered as part of Monsanto's program of furthering and expanding the use of agricultural chemicals by encouraging *safe handling* practices.

For your copy of this helpful poster, send in the coupon today.

Bulletin Describes New Sterox AJ Wetting Agent

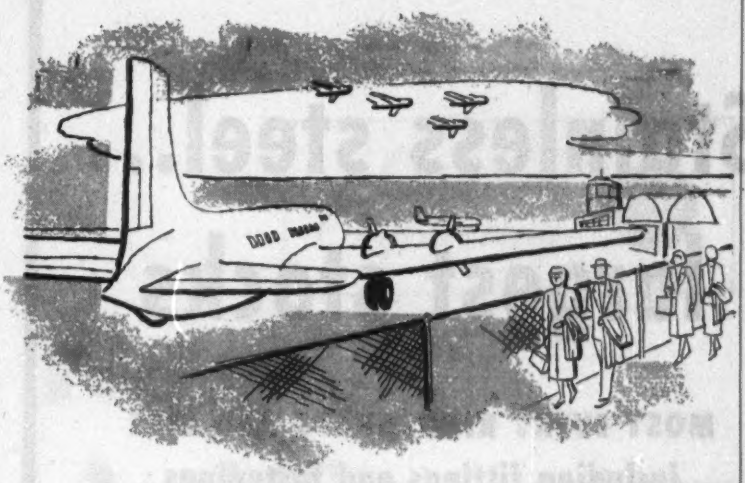
A new non-ionic surface-active agent with extremely high wetting and detersive properties is now available from Monsanto.

Called Sterox AJ, this new wetting agent possesses a faint, pleasing odor. It is chemically inert, stable and active over a wide range of conditions. This unusual stability coupled with superior surface-active properties makes Sterox AJ invaluable in a large number of applications.

Uses include laundering, paper rewetting, industrial cleaning compounds, detergent sanitizers, and textile processing.

A new bulletin, P-147, is available from Monsanto describing the composition, appearance, stability, wetting speed and other important chemical and physical properties.

ISOCYANATES — A NEW FIELD OF CHEMICAL TECHNOLOGY



To add strength without adding excessive weight, isocyanate foamed-in-place resins are used in ailerons and wing tips of aircraft.

Demonstrating its leadership and continuing expansion in the field of isocyanates, Monsanto has scheduled the construction of new multi-million-dollar production facilities.

From these facilities will come tons of isocyanates to augment Monsanto's present production which goes into such applications as intermediates, synthetic rubber, adhesives and foamed-in-place resins.

As intermediates Monsanto monoisocyanates have been used with outstanding results. They are important tools in the production of dyestuffs, pharmaceuticals and herbicides.

Rubber is another field where isocyanates have proved their worth by helping to make a synthetic rubber that is more abrasion-resistant, tear-resistant and less susceptible to ozone attack.

Foamed-in-place resins are—at present—one of the major applications of isocyanates. These resins fill intricate space without the usual labor required to form shapes to fit each cavity and are self-adhering to the walls of the space filled.

Adhesives is a field showing great promise. Here Monsanto diisocyanates are being used to produce adhesives which give strong, durable bonds between glass and metal, aluminum and aluminum, ceramic and glass, and many others.

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Chemical Engineering AUGUST 1953

Progress Today . . . . . And Tomorrow

AT LUNCH the other day a well-known chemical engineer hesitated a minute, then said:

"You talk about what's happening. Well, I've followed chemical engineering for some 37 years and I can tell you that we're making more progress, faster, and on a sounder basis today than ever before. Wherever you look, something hot's brewing. . . ."

. . . In Research

It's true. Talk to any research engineer and you'll get the same story of "something hot"—big or little—under way.

In half a dozen laboratories throughout the country you'll hear tantalizing bits about "jet reactors" and what they may mean to chemical plants and processes of the future.

Or about the strides being made in robotization (recently publicized as automation) that'll show up in new plants still on the drawing boards.

Or about recent work with "super-high" temperatures and pressures that call for brand new or vastly improved alloys and ceramic materials.

Just mention any unit operation (mixing) or any unit process (epoxylation) or any field or material (catalysis, ionic membranes) and you'll find someone predicting important new discoveries or applications coming up soon.

. . . In Confidence

Then our friend went on to explain what he was driving at:

"What's really behind this progress we're making today? Training and competence, yes—but our chemical engineers have always been a well-trained and competent lot. More important, I believe, is our new-found confidence . . . something we didn't have as a profession until World War II. . . ."

Perhaps that's true. For today the chemical engineer can be more confident than ever of his own training, acceptance and professional recognition. This has already led to a wider confidence in the entire chemical industry's research, its engineering, its management, its future role in the nation's economy.

It is also leading to bolder, less orthodox methods already showing up in today's new processes, equipment and operations. It is leading away from secrecy—which seldom gives protection, never leads to progress.

Let our young engineers remain competent, open-minded and confident and the chemical process industries will continue to progress—today and tomorrow.

John R. Callaham

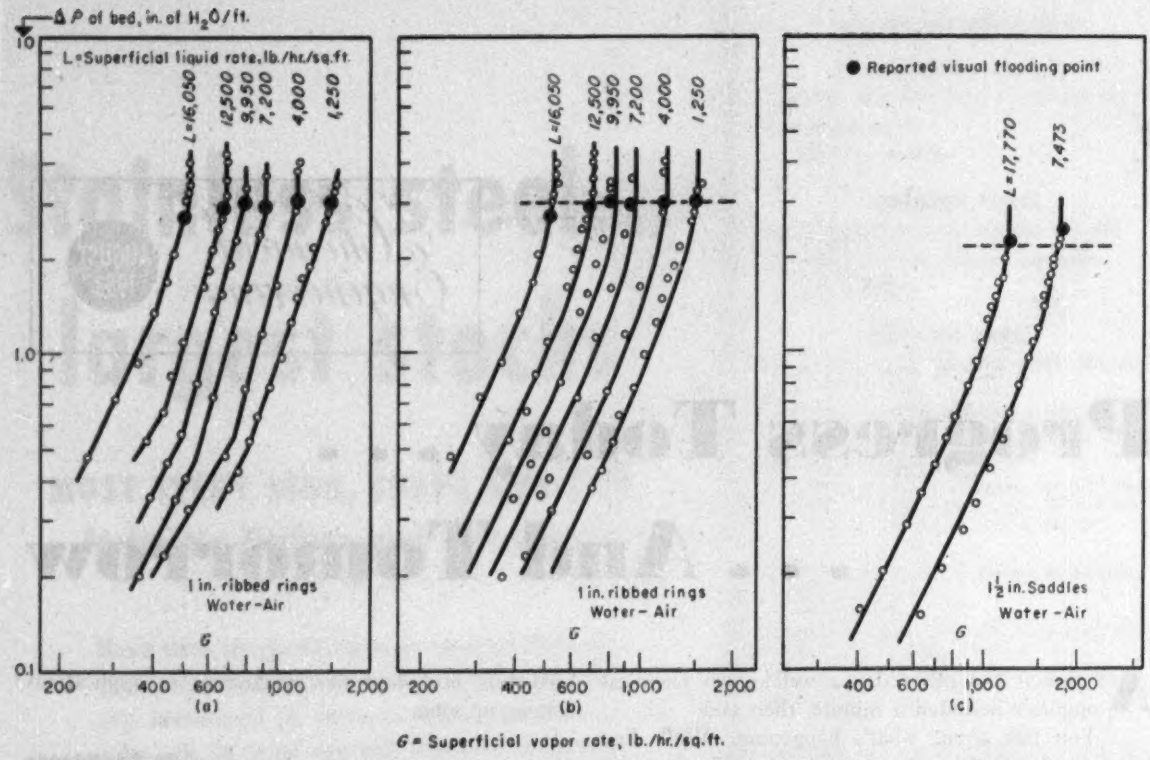


Fig. 1—Packed tower pressure drop and flooding data plot best as continuous smooth curves, not as three straight lines.

What Every Engineer Should Know

Lack of reliable design data and uncertainty of results have limited commercial uses

F. A. ZENZ

Although for many years packed towers have been looked on only as laboratory tools, more and more companies are now beginning to investigate commercial uses such as in the distillation of pharmaceuticals, solvent extraction and H_2S removal.

In most cases, though, commercial tower diameters have been limited to less than 4 ft. Application to larger units in which close fractionation or low holdup is essential—liquid air fractionation, for example—has been slow, not only because of volumetric cost considerations, but more surprisingly due to a general lack of data and information throughout industry.

The principle aim of this article is to clarify the physical interpretation of packed tower design and operation for the process engineer. A survey of packed tower studies reveals six major considerations: pressure drop curves, flooding point, pressure drop at flooding, the gas-continuous range, the liquid-continuous range and degree of wetting. The significance and interelation of these will be discussed in detail.

FRED ZENZ is a chemical engineer with Hydrocarbon Research, Inc., New York, N. Y. Previously he was associated with The M. W. Kellogg Co. and with the Manhattan Project. His several previous articles include "What Goes on Inside Bubble-Cap Towers," Chemical Engineering, April 1952.

Pressure Drop Curves

Pressure drop curves for packed towers operating at constant liquid rates should be correlated as smooth curves rather than as three straight-line regions.

Fig. 1a presents the pressure drop and flooding data for 1-in. ribbed raschig rings.[1a] These basic data are plotted in the conventional way using three straight lines to accentuate two discontinuities referred to as the loading and flooding points.[2] But smooth, continuous curves can also be drawn through these same points, as shown in Fig. 1b.

At first glance it may appear that the straight lines pass through more

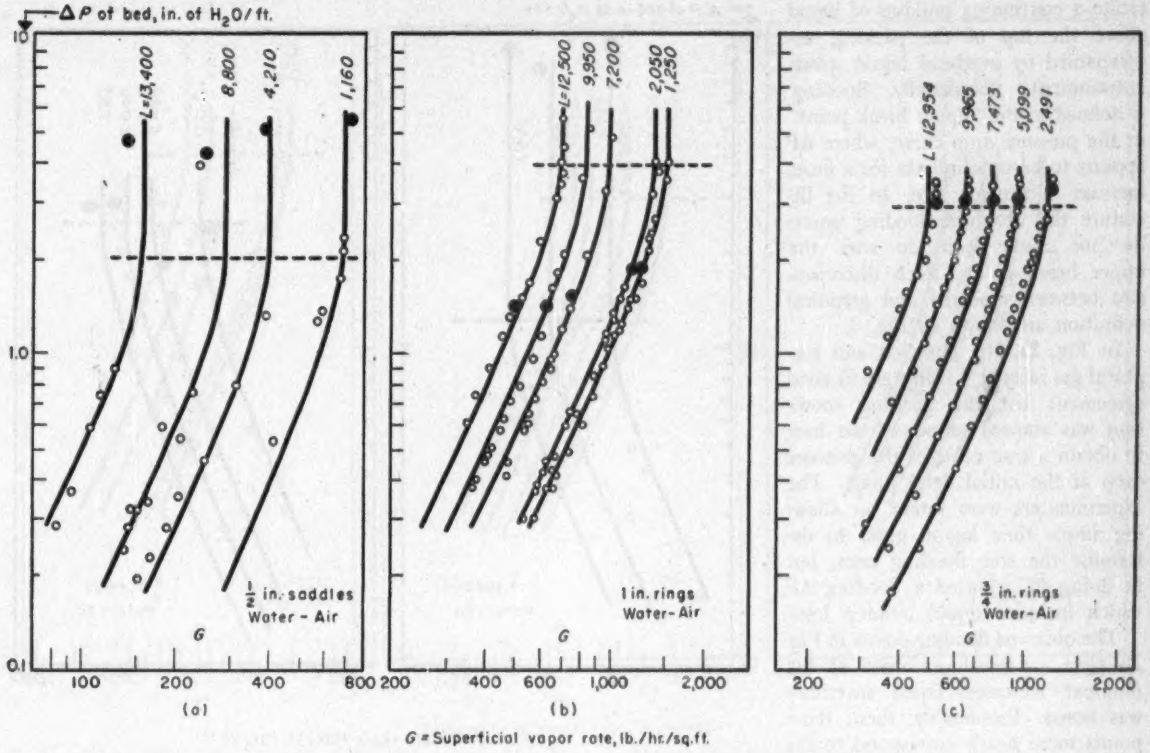


Fig. 2—Technique plays a big part in packed tower studies. These plots show two common errors and one good procedure.

About Packed Tower Operations

of packed towers. Here's a comprehensive analysis of the latest thinking in the field.

experimental points and therefore represent a better presentation of the data. However, a consideration of the entire field of published experiments —over 3,300 individual measurements in 52 plots—lends almost indisputable support to the smooth-curve method of correlating pressure drops and flooding rates.

The percentage deviation of experimental points from smooth curves drawn through them is substantially less than the experimental error in determining pressure drops through the bed. This difficulty in determining correct pressure drops is due mainly to fluid flow effects at the liquid distribution points and to end effects at the discharge points.

Tower operation in the region between loading and flooding points is very unstable and the accuracy of determinations—which may reflect equilibrium time lag dependency—hardly warrants drawing straight lines to indicate two such distinct breaks. The wide range of bed characteristics produced by various tower packing methods[3] also indicates the difficulties in making an accurate prediction of pressure drop for a proposed design and certainly overshadows the minor differences on which the straight-line hypothesis is established.

Fig. 1c shows smooth curves drawn through recent data for 1½-in. berl saddles.[4] All further plots of experimental data in this article are shown as smooth-curve correlations.

The Flooding Point

Flooding points are shown as "upper break points" in pressure drop vs. gas rate curves. At this point, pressure drop becomes infinite for a finite rise in gas rate.

The flooding point has been variously defined and measured in the literature and in many instances has been confused with the so-called loading point. By observation, the load point occurs when at constant liquid throughput, the gas rate increases to the point where a discernable increase in liquid holdup occurs at one or several points in the column.

Similarly, flooding is observed when still further increases in vapor rate

create a continuing buildup of liquid above the top of the packing, accompanied by overhead liquid splash entrainment. Graphically, flooding is defined as the "upper break point" in the pressure drop curve, where ΔP appears to become infinite for a finite increase in the gas rate. In the literature the observed flooding points do not always coincide with the upper break point. Such discrepancies between observed and graphical definition are shown in Fig. 2.

In Fig. 2a, the observed and graphical gas rates at flooding are in good agreement but the flooding condition was allowed to persist too long to obtain a true value of the pressure drop at the initial flood point. The experimenters were intent on allowing ample time lag in order to determine the true flooding rates, but in doing so, reported a flooding ΔP which included liquid buildup loss.

The observed flooding points in Fig. 2b were apparently recorded at the moment increased liquid inventory was noted. Presumably, then, these points more nearly correspond to the loading points.

Fig. 2c is an example of good agreement between observed and graphical values and is the result of careful experimental technique. The vast majority of published data falls in this category.

Certainly there can be only one true flooding point. In view of the human elements involved, as well as the theoretical treatment of packed tower flow as analogous to flow through valves and orifices,[8] it appears that the upper break point is the best representation of true flooding condition. This analysis is further supported by a comparison of the mean deviations of observed and predicted flooding gas rates as determined from the best curves drawn through the generally accepted Sherwood flooding correlation.[8] Using observed flooding and upper break points as the basis of correlation, this deviation was ±16.17 percent.

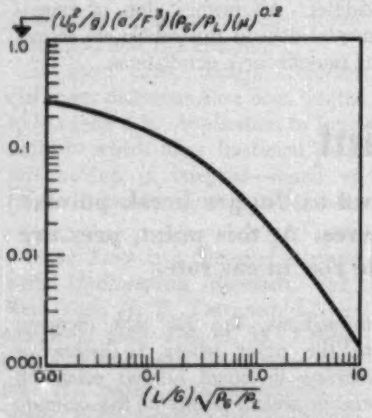


Fig. 3—Sherwood flooding correlation can be used to solve design problems.

On the other hand, the mean deviation between graphical and predicted upper break points on the same basis was only ±11.09 percent. Fig. 3 shows the Sherwood flooding correlation.

Newton, *et al*, recently reported a study of the effect of liquid surface tension on the flooding capacity of packed towers.[7] They propose multiplying the abscissa of Fig. 3 by the cube root of the ratio of liquid to water surface tensions and then using this modified construction as the new abscissa. They report good agreement between observed flooding rates and the break points, but do not present pressure drop curves in their paper.

The true flooding point can occur at any point in the tower. Presumably, though, it will start at the point of greatest restriction to flow which, in view of the complexity and random nature of packing, has suggested statistical consideration of the free area distribution in packed towers.[8] However, such studies are not justified for engineering purposes because of the large safety factors normally applied in design.

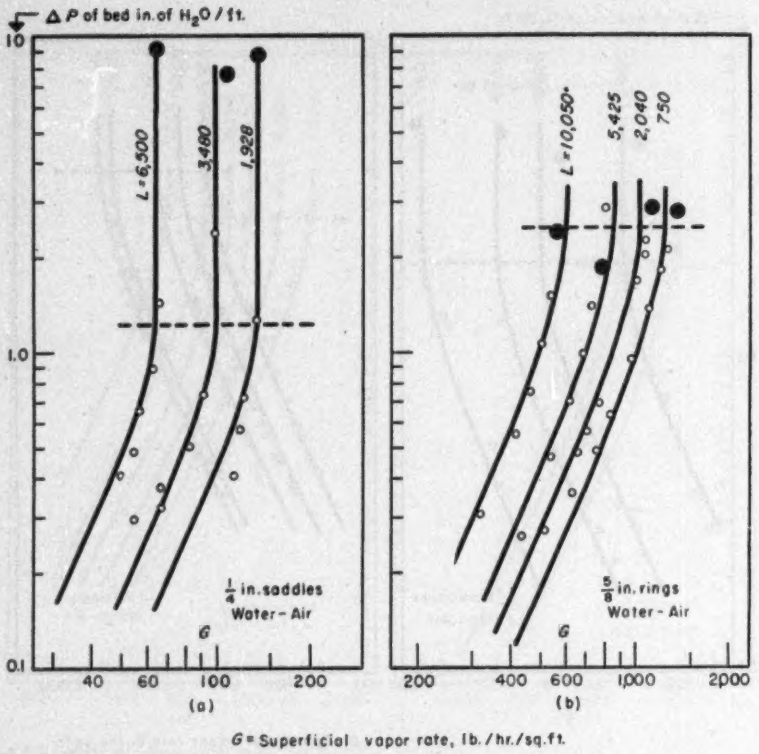


Fig. 4—Both packing and liquid properties have pronounced effects on pressure . . .

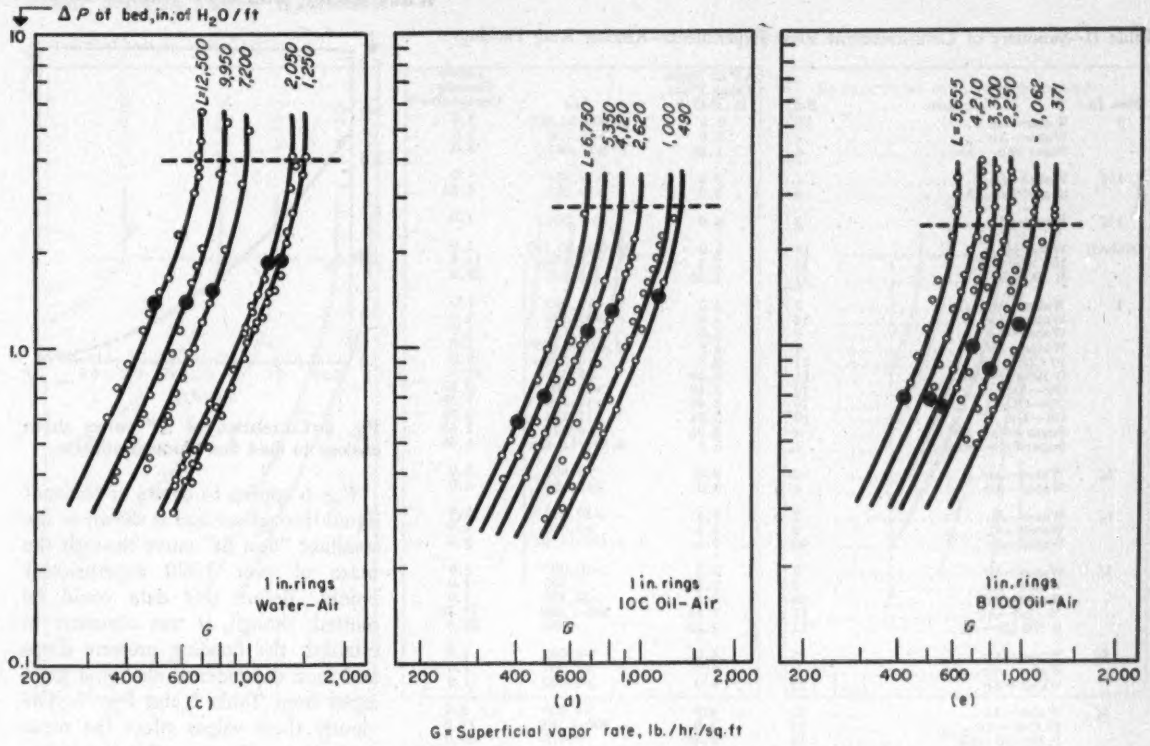
It is interesting to note that for a given vapor-liquid system and a given packing, this simple relationship holds rather well:

$$\sqrt[3]{v_G} + \sqrt{v_L} = \text{constant}$$

This constant varies from about 28 to 32 with packing size and shape, with liquid viscosity, and to a minor extent with the density of the gas. As packing size increases, the constant also increases; as liquid viscosity and gas density increase, however, the constant decreases.

The equation is most useful in predicting all combinations of flooding liquid and gas rates for a given packed tower when one flooding point is known.[9]

A complete table of packed tower nomenclature for this article can be found on page 183.



. . . drops at flooding. Bigger packing results in greater pressure drops while a higher liquid viscosity gives a lower ΔP_F.

Pressure Drop at Flooding

At the upper break point, pressure drop is a function only of the characteristics of the packing material and of the physical properties of the down-flowing liquid.

A study of all the published data—considering the upper break points as the true flooding points—leads immediately to the conclusion that the pressure drop at flooding is constant for any particular tower. It is a function only of the packing size and shape and of the properties of the liquid flowing down the tower.

Fig. 4a,b,c, shows the effect of packing characteristics on the pressure drop at flooding; Fig. 4c,d,e, shows the effect of liquid properties. The upper break point pressure drops—with water as the down-flowing liquid—are tabulated as a function of packing characteristics in Table I.

It was surprising to find such good agreement among the various investigators. Wide variations in bed characteristics, resulting from the widely varying methods of packing, would be expected to lead to considerable differences in the observed flooding pressure drops. Such was not the case, however, when the data of several investigators working with the same system was compared. And in any case, it is probable that any such deviations would be of the same order of magnitude as the deviations in flooding rates from the Sherwood correlation, well within the degree of accuracy required in most design problems.

For systems other than water, the flooding pressure drops correlate best with the kinematic viscosity of the liquid, as shown in Fig. 5. A summary of the flooding pressure drops for all systems reported in the literature is shown in col. 4 and 6 of Tables II and III. Thus, the combination of Table I and Fig. 5 gives a ready means of estimating the pressure drop at flooding for any system in saddle or ring-packed towers.

Table I—Pressure Drop at Upper Break Point With Water as the Flowing Liquid

Raschig Rings	ΔP_F, In. H_2O/Ft.
2 in.	2.5
1½	2.5
1¼	4.0
1 (ribbed)	3.0
1	4.0
¾	3.0
⅝	2.5
½	3.5
⅜	4.0
¼	4.0
Berl Saddles	
1½ in.	2.2
1	2.5
¾	2.5
½	2.0
¼	1.25

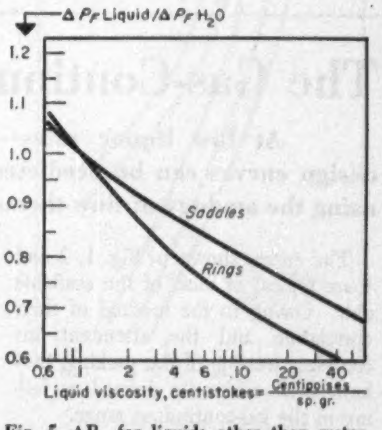


Fig. 5—ΔP_F for liquids other than water is calculated from liquid viscosities.

Table II—Summary of Countercurrent Flow Experiments—Raschig Ring Packings

Size, In.	System	Ref.	ΔP at Upper Break Point, In. H_2O/Ft.	L_{LC}	Liquid Viscosity, Centistokes
2	Water—Air	17	2.5	13,200–24,800	1.0
	Water—Air	4	2.5	>17,736	1.0
	Sugar Soln—Air	4	1.88	>17,061	8.6
1½	Water—Air	4	2.5	>12,954	1.0
	Sugar Soln—Air	4	2.0	>17,062	4.53
1¼	Water—Air	2	4.0	>7,560	1.0
1 (ribbed)	Water—Air	18	3.0	16,050–20,200	1.0
	10 Coil—Air	11	2.1	>3,450	14.6
	B 100 Oil—Air	11	1.85	>5,650	38.0
1	Water—Air	2	4.0	>7,350	1.0
	Water—Air	18	4.0	>12,500	1.0
	Water—Air	8	4.0	>8,770	1.0
	Water—Air	4	4.0	7,474–9,965	1.0
	10 Coil—Air	11	2.8	>6,750	10.8
	B 100 Oil—Air	11	2.45	>5,655	37.3
	Oil—Air	19	3.48	>10,480	2.25
	Oil—CO_2	19	3.40	>11,720	2.59
	Oil—H_2	19	3.38	>11,230	2.73
	Sugar Soln—Air	4	2.95	>6,021	7.63
	Sugar Soln—Air	4	3.1	8,534–11,432	4.66
¾	Water—Air	2	3.0	>7,500	1.0
	Water—Air	4	3.0	>12,954	1.0
⅝	Water—Air	2	2.5	>10,050	1.0
	Water—Air	2	2.5	>7,350	1.0
	Water—Air	10	2.5	8,160–11,460	1.0
½	Water—Air	2	3.5	>10,050	1.0
	Water—Air	2	3.5	>7,500	1.0
	Water—Air	11	3.5	>10,170	1.0
	10 Coil—Air	11	2.45	500–1,000	11.30
	B 100 Oil—Air	11	2.15	<325	32.0
⅜	Water—Air	2	4.0	>2,040	1.0
	Water—Air	2	4.0	>7,200	1.0
	Water—Air	20	4.0	>6,800	1.0
¼	Water—Air	11	4.0	>4,550	1.0
	10 Coil—Air	11	2.8	700–1,000	11.6
	B 100 Oil—Air	11	2.45	<475	35.0

Table III—Summary of Countercurrent Flow Experiments—Berl Saddle Packings

Size, In.	System	Ref.	ΔP at Upper Break Point, In. H_2O/Ft.	L_{LC}	Liquid Viscosity, Centistokes
1½	Water—Air	4	2.2	>17,770	1.0
	Sugar Soln—Air	4	1.81	>19,376	7.8
	Sugar Soln—Air	4	1.75	>12,092	14.7
1	Water—Air	8	2.5	>11,100	1.0
	Water—Air	20	2.5	>6,520	1.0
	Water—Air	4	2.5	>9,965	1.0
	Sugar Soln—Air	4	2.15	>19,785	4.3
	Sugar Soln—Air	4	2.0	>15,411	11.3
¾	Water—Air	8	2.5	>8,050	1.0
	Water—Air	4	2.5	9,965–12,954	1.0
	Sugar Soln—Air	4	2.05	>11,796	7.81
½	Water—Air	10	2.0	13,400–16,610	1.0
	Water—Air	11	2.0	>10,300	1.0
	10 Coil—Air	11	1.55	2,080–2,950	14.6
	B 100 Oil—Air	11	1.4	1,500–2,250	39.0
¼	Water—Air	10	1.25	>6,500	1.0

The Gas-Continuous Range

At low liquor rates—the gas-continuous range—design curves can be predicted from the flooding point by using the analogy of flow through valves and orifices.

The curves shown in Fig. 1, 2 and 4 are typical of most of the available data. Owing to the method of their correlation and the attendant incomplete wetting of the packing, they have been arbitrarily defined as falling in the gas-continuous range.

If we accept the theses that (a) pressure drop curves can be correlated as smooth curves, (b) the true flooding point is best represented by the upper break point and (c) the pressure drop at the upper break point is a function of packing and liquid properties, it is then possible to correlate pressure drop curves in the gas-continuous range in terms of the flooding point (Fig. 6).

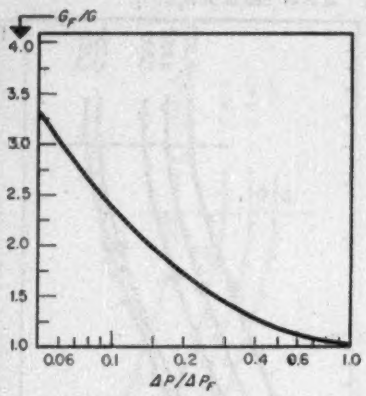


Fig. 6—Correlation of ΔP curves shows analogy to fluid flow through orifices.

Fig. 6 applies to curves of constant liquid throughout and is shown as the resultant "best fit" curve through the maze of over 3,300 experimental points. Before this data could be plotted, though, it was necessary to establish the flooding pressure drops and their dependence on liquid properties from Table I and Fig. 5. Obviously these values affect the mean deviations. However, this is a minor effect in view of the already low mean deviation—under 10 percent—for all the data investigated.

Any attempt at establishing such a correlation of pressure drop data by the "least squares" method is obviously almost impossible due to the dependence on fluid properties and packing size. It would involve a tedious analytical solution of one trial and error procedure within another. This could hardly be justified in view of the degree of accuracy needed.

It has been suggested that in the gas-continuous range, constant liquid rate is analogous to constant ratio of throat area to pipe area in orifice flow.[9] The area open to gas flow through a packed tower—which corresponds to orifice throat area—is dependent on two factors, liquid holdup and free void in packing. Determinations of the effect of both liquid and gas rates on holdup show that at a fixed liquid rate, holdup is essentially independent of gas rate. This suggests the orifice flow analogy.

This analogy is presented only for its suggestive nature rather than as a real physical similarity since flooding gas rates are neither sonic nor necessarily adiabatic. It does however, aid in the comprehension of flow behavior in the gas-continuous range.

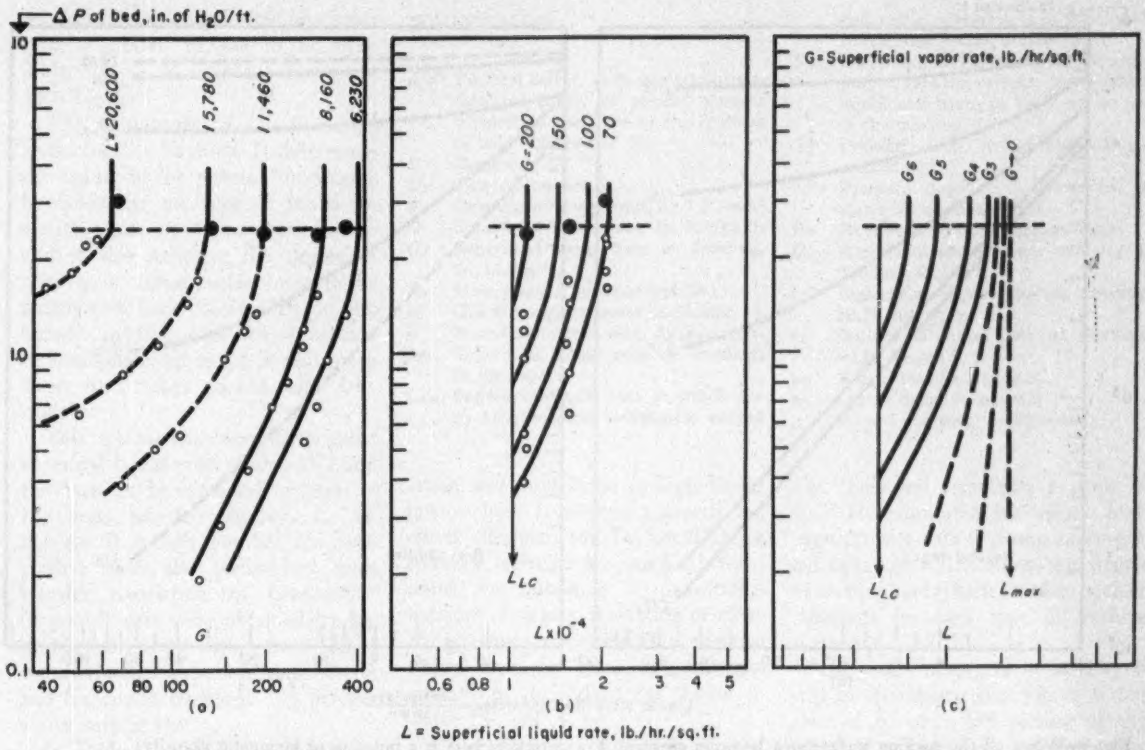


Fig. 7—ΔP data in the liquid-continuous range correlate satisfactorily when plotted vs. liquid rather than gas rates.

The Liquid-Continuous Range

At high liquor rates—the liquid-continuous range—pressure drop curves indicate the existence of maximum liquid capacity below the super-flood region.

Packed towers do not always operate in the gas-continuous range. For any particular packing and liquid system there appears to be a critical liquid rate above which the pressure drop curve begins to deviate from the correlation shown in Fig. 6. An example of this pronounced deviation is shown in Fig. 8 for ½-in. berl saddle packings.[11]

This critical liquid rate is known as L_{LC} and tower operation at rates above it has been arbitrarily designated as being in the liquid-continuous range. The significance of L_{LC} and its use in design problems will be discussed later.

In the past, pressure drop curves for liquid rates above L_{LC} have been correlated empirically in a rather unsatisfactory manner.[8] However, it can now be shown that the data fit Fig. 6 if the pressure drop curves are considered as lines of constant gas rate vs. liquid flow.

Consider, for example, the ½-in. ring data plotted in the conventional manner in Fig. 7a.[10] At liquid rates below about 10,500 lb./hr./sq. ft., the system appears to behave as anticipated in the gas-continuous range. But at higher liquid rates, the curves deviate considerably from the form of Fig. 6.

The dotted curves of Fig. 7a have been cross-plotted in Fig. 7b as lines of constant gas rate. They now can be correlated with Fig. 6 by considering the abscissa as L_r/L rather than as G_r/G.

Fig. 7b also shows the concept of ultimate liquid capacity of a packed tower. A schematic plot of this is shown in Fig. 7c. Note that the nature of the curves indicates that at zero gas rate there exists a maximum

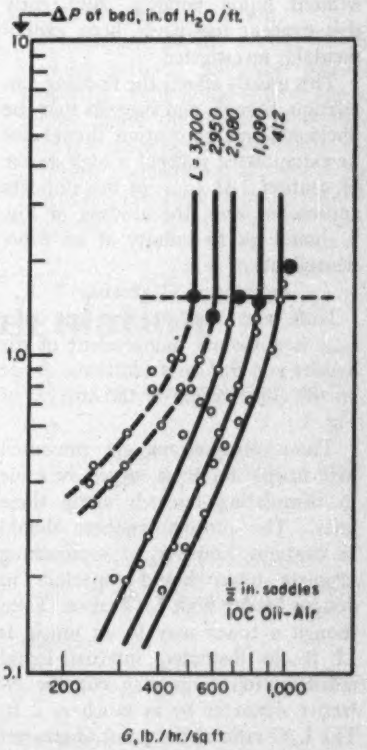


Fig. 8—These curves in the range above L_{LC} point up deviations from Fig. 6.

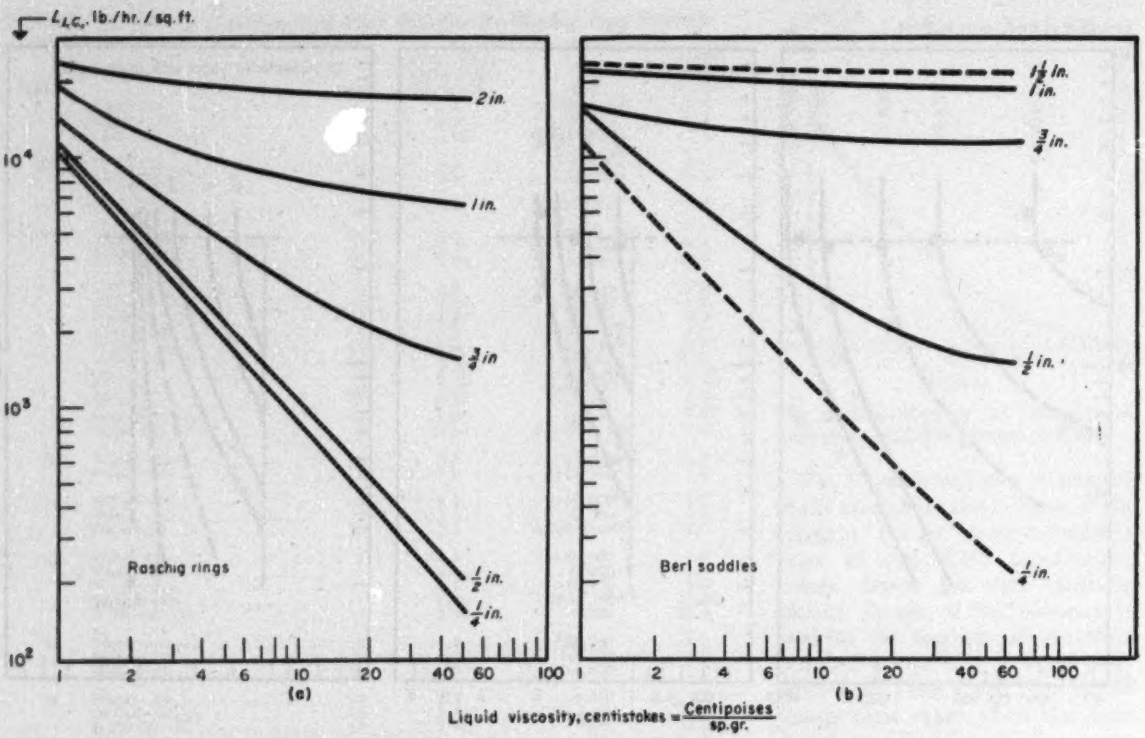


Fig. 9—When all the packing surface area becomes effective, L_{LC} correlates best as a function of kinematic viscosity.

permissible liquid throughput, L_{max}, without liquid buildup. Apparently this concept has never been experimentally investigated.

This greatly affects the flooding correlation, though, and suggests that the Sherwood-type correlation should not be extrapolated without a high degree of caution. At L_{max}, as the ordinate approaches zero, the abscissa of Fig. 3 should go to infinity at an exponential rate of −2:

$$\text{ordinate} = C(\text{abscissa})^{-2}$$

Note also that at zero gas rate, L_{max} is obviously independent of gas density and this casts additional doubt on the construction of the abscissa of Fig. 3.

These observations are presented here mainly for their suggestive value in stimulating research along these lines. The process engineer should be cautious, however, of approaching ultimate tower liquid capacities in designs having high L/G ratios. Even though a tower may be as much as 12 ft. in diameter, internal liquid redistribution rings may cut the effective diameter by as much as 2 ft. The L/G ratio at the point of greatest restriction will, of course, be of primary concern.

Degree of Wetting

The change in tower operation from gas-continuous to liquid-continuous appears to occur at the liquid rate corresponding to complete wetting of packing.

The significance of L_{LC} is distinctly related to the degree of wetting. Data recently reported by several investigators leads to the conclusion that L_{LC} is the minimum liquid rate which completely wets the packing. It is, therefore, the minimum liquid rate at which essentially all the packing surface area becomes effective for gas-liquid contact.

Data in the liquid-continuous range of tower operations is much less abundant than in the gas-continuous range and only a crude attempt at correlation is permissible. The L_{LC} data gleaned from pressure drop analyses are shown as a function of liquid kinematic viscosity in Fig. 9. These plots are based on the data summarized in col. 5 and 6 of Tables II and III.

Grimley[23] has presented a plot of percentage wetted area for ¾-in. rings as a function of liquid throughput rate. His curve indicates 100 percent wetting at a water rate of 11,000 lb./hr./sq.ft. which is in good agreement with what would be predicted by interpolation from the kinematic viscosity correlation of Fig. 9a.

Similarly, the data of Shulman and De Gouff[18] indicate that 1-in. rings

Table IV—Effect of Wetted Area Correction on Correlation of Mass Transfer Coefficients for NH_3-H_2O System Using 1-in. Raschig Rings

Liquid Rate, Lb./Hr./Sq.Ft.	J_D at Re = 1,000, Based on Total Packing Area, $J_D = Ck_g/G$	Ref.	Effective Wetted Area,* Sq.Ft./Cu.Ft.	J_D at Re = 1,000, Based on Wetted Area
1,100	0.016	21	16	0.058
2,050	0.021	22	21	0.058
4,500	0.0275	23	28	0.057
$>L_{LC}$**	0.059	14, 15	58	0.059

* Based on the data of Shulman and De Gouff (13)
** Maximum effective surface area

would be completely wetted at a water rate of about 18,000 lb./hr./sq.ft. This, too, is in excellent agreement with Fig. 9.

The significance of L_{LC} in design work, then, is twofold. It determines the nature of the pressure drop curve by indicating the type of tower operation—gas- or liquid-continuous—and it also indicates the degree of wetting or active surface area to be anticipated. Let's consider the gas film transfer coefficient for the absorption of ammonia from an air stream using water in a tower packed with 1-in. rings.

This system has been investigated at several liquid rates (Table IV) and the data can be expressed in terms of the mass transfer number, J_D, vs. the gas Reynold's number for comparison with the packed-bed mass transfer correlation of Gamson.[14,15] Gamson's data were obtained by humidification of air with a fixed bed of water-saturated cylinders and spheres and his curves represent 100 percent active surface area.

In Table IV, col. 2, the mass transfer numbers at a gas Reynold's number of 1,000 are tabulated for the ammonia-water data obtained at the liquid rates of col. 1. The mass transfer number from Gamson's correlation is also shown and represents the maximum attainable transfer coefficient for 100 percent wetted packing, or operation at liquid rates above L_{LC}.

All gas film mass transfer numbers computed from reported absorption studies fall below the Gamson correlation and only those at high liquid rates—above L_{LC}—even approach the curve. Shulman and De Gouff[13] have recently reported an excellent technique for obtaining a quantitative measure of degree of wetting or effective packing surface area. The effective wetted areas for 1-in. rings, interpolated from their data, are shown in Table IV, col. 4.

Using these wetted areas in the calculation of absorption coefficients, the mass transfer numbers shown in col. 5 were obtained. Note that the previously disturbing effect of liquid rate on gas-film-controlled absorption is now accounted for and correlates well within the degree of experimental error.

Pratt [16] reports a study of "minimum effective liquid rates" which he defines as the rate at which the packing becomes as fully wetted as possible. This was essentially a study of L_{LC}. He computed his values from mass transfer data by using an empirical equation which allows for degree of wetting and which involves specific constants for each type of packing material.

The study of degree of wetting is still in its infancy and Fig. 9 is not claimed to be a full picture of the effects of packing and liquid properties. However, it does show a good order-of-magnitude estimate suitable for process design analyses, well within the degree of accuracy required.

The nature of the surface of the packing material and the physical properties of the liquid will, of course, greatly affect the degree of wetting. And it is quite possible, therefore, that complete correlation will prove as elusive as has the study of liquid foaming properties.

NOMENCLATURE

- a/F^3 Packing factor, sq.ft. of packing surface per cu.ft. of packed volume divided by the cube of the fraction of void volume (ref. 3)
- C Constant
- D_T Tower diameter, ft.
- g Gravitational constant, 32.2 ft./sec.^{2}
- G Superficial vapor rate, lb./hr./sq.ft.
- G_F Superficial vapor rate at flooding, lb./hr./sq.ft.
- J_D Mass transfer number (ref. 14)
- k_g Gas film mass transfer coefficient
- L Superficial liquid rate, lb./hr./sq.ft.
- L_F Superficial liquid rate at flooding, lb./hr./sq.ft.
- L_{LC} Superficial liquid rate at which the packing becomes completely wetted and tower operation is in the liquid-continuous range, lb./hr./sq.ft.
- L_{max} Maximum attainable liquid throughput, at zero vapor rate, above which liquid will begin to build up on top of the packing
- ΔP Pressure drop, in. of water/ft. of packed bed
- ΔP_F Pressure drop at flooding, in. of water/ft. of packed bed
- Re Reynold's number, dimensionless
- U_o Superficial tower vapor velocity at flooding, ft./sec.
- v_G Superficial vapor rate at flooding, cu.ft./hr./sq.ft.
- v_L Superficial liquid rate at flooding, cu.ft./hr./sq.ft.
- ρ_G Vapor density, lb./cu.ft.
- ρ_L Liquid density, lb./cu.ft.
- μ Liquid viscosity, centipoises

Typical Packed Tower Design Calculation

Let's investigate the design of a packed tower to handle 1,350 lb./hr. of vapor at liquid rates ranging from 75,000 to 151,000 lb./hr. Assume that 1 in. raschig rings will be used. Selection of optimum packing size, which would involve transfer coefficients and degree of wetting considerations, will not be considered.

It is desired to estimate the required tower diameter and the pressure drops at the two extremes of liquid rate. Process calculations give the following information:

Vapor = 1,350 lb./hr.
Liquid = 75,000–151,000 lb./hr.

ρ_G = 0.08 lb./cu.ft.
ρ_L = 40 lb./cu.ft.
μ = 10 centipoises

The minimum tower diameter will obviously be determined by the combined maximum liquid and vapor loads. Assuming that desired operation will be at 50 percent of the flooding gas rate when the liquid load is 151,000 lb./hr., then

$$\frac{L}{G}\times\sqrt{\frac{\rho_G}{\rho_L}}=\frac{151{,}000}{2\times 1{,}350}\sqrt{\frac{0.08}{40}}=2.5$$

From Fig. 3:

$$\frac{(U_o)^2}{g}\times\frac{a}{F^3}\times\frac{\rho_G}{\rho_L}\times\mu^{0.2}=0.01$$

a/F^3 for 1 in. rings is about 160 (ref. 3).

Then,

$$(U_o)^2=\frac{0.01\times 32.2\times 40}{160\times 1.585\times 0.08}=0.636$$

$$U_o = 0.8 \text{ ft./sec.}$$

$$D_T=\sqrt{\frac{1{,}350\times 2\times 4}{3{,}600\times 0.08\times 0.8\times\pi}}=4 \text{ ft.}$$

Therefore,

$$L_1=151{,}000\Big/\frac{\pi(4)^2}{4}=12{,}000 \text{ lb./hr./sq.ft.}$$

Similarly,

L_2 = 5,960 lb./hr./sq.ft.
and G = 108 lb./hr./sq.ft.

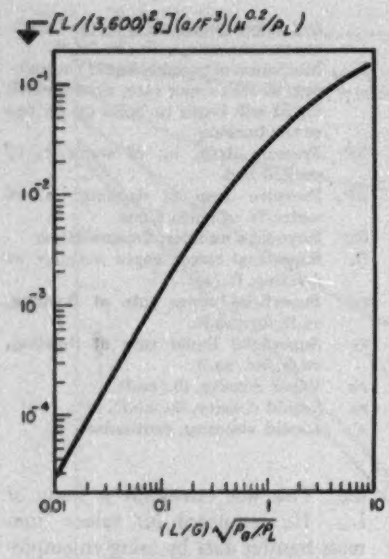


Fig. 10—Alternate Sherwood correlation greatly simplifies design calculations.

$$\frac{\mu}{\text{sp. gr.}} = 10 \Big/ \frac{40}{62.4} = 15.6$$

From Fig. 9: L_{LC} = 7,500 lb./hr./sq.ft.

At a liquid rate of 75,000 lb./hr. (L = 5,960 lb./hr./sq. ft.), the tower will operate in the gas-continuous range since L is less than L_{LC}.

From Table I: ΔP_F = 4.0 for water

From Fig. 5: ΔP_F correction = 0.675

Therefore, ΔP_F = 0.675 x 4.0 = 2.7 in. H_2O/ft.

In order to determine the actual pressure drop from Fig. 6, it is necessary to find the flooding gas rate at this liquid load. This can be done by trial and error using Fig. 3, but a simpler way is to express the abscissa of Fig. 3 in terms of U_s:

$$\frac{L}{G} \times \sqrt{\frac{\rho_G}{\rho_L}} = \frac{L}{3{,}600 \times U_s \times \rho_G} \times \sqrt{\frac{\rho_G}{\rho_L}}$$

The product of the square of the abscissa times the ordinate gives:

$$\left[\frac{L}{3{,}600 \times U_s \times \rho_G} \times \sqrt{\frac{\rho_G}{\rho_L}}\right]^2 \times \left[\frac{(U_s)^2}{g} \times \frac{a}{F^3} \times \frac{\rho_G}{\rho_L} \times \mu^{0.2}\right]$$

which simplifies to

$$\frac{L^2}{(3{,}600)^2 \times g} \times \frac{a}{F^3} \times \frac{\mu^{0.2}}{(\rho_L)^2}$$

$$= \frac{(5{,}960)^2 \times 160 \times 1.585}{(3{,}600)^2 \times 32.2 \times (40)^2} = 0.0135$$

The new plot (Fig. 10) presents a ready means of calculating the flooding gas rate corresponding to a fixed liquid flow.

From Fig. 10: $\frac{L}{G} \times \sqrt{\frac{\rho_G}{\rho_L}} = 0.54$

Therefore, $G_F = \frac{5{,}960}{0.54} \times \sqrt{\frac{0.08}{40}} = 495$

and $\frac{G_F}{G} = \frac{495}{108} = 4.6$

By extrapolating Fig. 6: $\frac{\Delta P}{\Delta P_F} = 0.03$

Therefore, the anticipated pressure drop = 0.03 x 2.7 = 0.081 in. H_2O/ft.

At a liquid rate of 151,000 lb./hr. (L = 12,000 lb./hr./sq. ft.), the tower will operate in the liquid-continuous range since L exceeds L_{LC}. The problem must now be treated as illustrated in the text discussion of the liquid-continuous range. At a constant vapor load of 1,350 lb./hr., it is necessary to determine the flooding liquid rate.

Thus, $U_s = \frac{1{,}350}{3{,}600 \times 0.08 \times \pi \times (4)^2/4}$

= 0.373 ft./sec.

From Fig. 3: $\frac{L}{G} \times \sqrt{\frac{\rho_G}{\rho_L}} = 7.5$

Therefore, $L_F = 7.5 \times 108 \Big/ \sqrt{\frac{0.08}{40}}$

= 18,000 lb./hr./sq.ft.

and $\frac{L_F}{L} = \frac{18{,}000}{12{,}000} = 1.5$

From Fig. 6: $\frac{\Delta P}{\Delta P_F} = 0.26$

and ΔP_F again = 2.7 in. H_2O/ft.

Therefore, the anticipated pressure drop in this case = 0.26 x 2.7 = 0.7 in. H_2O/ft.

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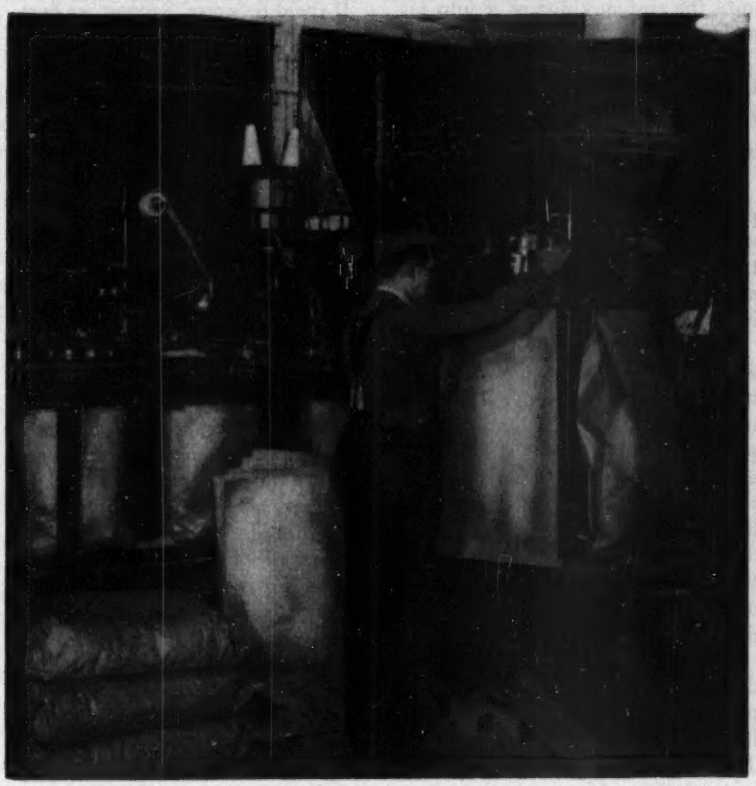

"Automatic and semi-automatic equipment usually deliver more dependable packing accuracy than manual equipment."

"Suppose our material cakes badly under pressure."

Watch Those Hidden Packaging Costs

There's more to packaging costs than appears on the cost sheet. Here are some examples of how the wrong choice of container and equipment can multiply your estimates of packaging costs beyond all reason.

R. F. UNCLES and T. L. CARTER

Why should packaging seem unimportant to most chemical engineers? Maybe because it's such a small item on the cost sheet. Packaging costs do seem insignificant when compared with the costs of raw materials, processing and distribution.

But it is a mistake to judge the importance of the subject by its numerical rating. In the first place, very seldom does the true cost show up on the cost sheet. Only the first costs are recorded—the container, the equipment, the labor to fill the containers and maintain the equipment.

The true cost would have to include the *effects* of packaging—the losses, the extras, the intangible but positive effects on sales and profits.

And since the effects of packaging are directly dependent upon the choice of containers and equipment, it is in the making of these choices that the minimum costs and greatest benefits of good packaging are separated from the consequences of poor packaging.

This article is not intended as a ready reference, with answers to all packaging problems. Its purpose, rather, is to emphasize and explain how an unwise choice can easily lead to serious and costly errors, sometimes discovered too late for correction.

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WHAT ABOUT THE CONTAINER?

Take, for instance, a new product which has been dropped in our lap for packaging. It is a finely ground white powder, about like flour. Weighs 30 lb. per cu. ft. Sales estimates are for about 6 million lb. a year, to be used mostly by small formulators—50 to 200 lb. per batch. Definitely not a shelf item.

Our first thought will be to the container. We naturally want the cheapest one possible that will meet all requirements. It shouldn't be hard at that; there aren't so many—boxes, barrels, bottles, drums and bags—made of wood, metal, glass, plastic and paper.

We certainly don't need the high-priced specials or the liquid contain-

ers. We'll consider only the two old chemical "regulars"—fiber drums and paper bags.

Two things determine the size of the container—the density of the material and the quantity most convenient for the customer's use. Since it's not a shelf item, small packages are out; we've got to work in the 50-200 lb. range and our material weighs 30 lb. per cu. ft.

A 50-gal. fiber drum will hold about 200 lb. of our stuff and will cost about $2. That's about 1 c. per lb. for the container.

A simple paper bag that will hold 50 lb. of the material costs about 10 c.—that's about 0.2 c. per lb. for the container. Drums would cost five times as much as bags for our purpose. Let's see, for 6 million lb. per year that would be $60,000 worth of drums, but only $12,000 worth of bags. No wonder we see so many bags—but then, there are a lot of drums around, too. Let's check into that further.

DON'T OVERLOOK BREAKAGE

How valuable is the material, and what happens if we break a few bags in shipment? One or two per carload would not be considered bad shipping. Suppose the broken bags are considered a total loss because of contamination or spoilage. We might be able to collect continuous claims from the railroad, but, at best, the trouble of bookkeeping and claim justification would be a nuisance to us and more so to the customer.

The trouble might be magnified all out of proportion if the bags were not acceptable as suitable containers by the railroad and no claims were allowable. Or suppose the freight rates went up 20 percent. It could happen, and it's worth looking into.

Could it just be possible that the material is hygroscopic? A simple little item, but if moisture absorbed readily from the air could ruin the quality, a plain bag would not be satisfactory. We may have to use an asphalt ply, or a plastic liner. We may have to use tape over sewing; we may even have to wax-dip the ends. Suppose, even, we have to provide a dehumidified packing room.

Remember, the container will be our only protection from the time we pack the product, through shipment and storage, hot or cold, wet or dry, until the customer dumps it into his mixer.

Yet even if we doubled the price of the bag, it would still be $36,000 a year cheaper than using drums.

WATCH THE UPS AND DOWNS

What about sales regularity? Do we produce this material year-round or is it a seasonal item? It does affect the true cost of packaging. Look at the difference it would make in warehousing.

We can store in bulk and pack as we ship to save warehousing the finished product, but we can't avoid storing the empties. And if our inventory policy requires a month's supply of empties, that would mean for year-round production a half carload of bags or eight carloads of drums. To double this quantity for a six-month seasonal basis would mean one carload of bags or 16 carloads of empty fiber drums.

Sales regularity won't make much difference to bags, but it is very important if we've chosen drums. And it's not only the extra space involved. The bags come palletized and will cost only $6 or $8 per month to handle. The drums, on the other hand, must be handled one at a time, the hard way, and will cost $100 or so per month.

We don't pay these extras to the drum manufacturer, and they probably won't show on the cost sheet as packaging costs. But we still pay them as extras in space rent, freight charges and increased handling labor. And the choice of container is the only way to control them.

EFFECT ON FILLING COSTS

Watch out for that seasonal hazard. It can double or triple the filling rate we would plan for year-round operation. Since we're still leaning toward bags for our product, let's see what effect seasonal packaging could have on our plans.

Let's assume a screw-type valve-bag filler that we've tried and know will fill a bag in a little less than 1 min. That's just right for our year-round basis with one machine and one operator.

But for a six-month season, we would need at least two machines and maybe two operators. We'd have to add $4,000 or $5,000 extra for seasonal equipment.

It could be worse. Suppose we overlooked the seasonal effect on a high-speed line where year-round packing meant 10 to 15 bags per min. The packer could cost $20,000 to $50,000 and require three or four operators.

BULK DENSITY CAN CHANGE

It is almost impossible to separate any discussion of containers from packing equipment and operating labor, but let's pick up another point on container costs.

We said the size of a container is established partly by density, and our sample weighed 30 lb. per cu. ft. But in spite of the fact that we obtained a fresh sample, we may still have overlooked a physical characteristic which could have a serious effect on the container size.

The fresh sample, although only an hour old, may have already settled to the extent that it was not at all representative of the density which will be delivered to the packaging machine. Some materials settle naturally much faster than others; our sample may have settled 20 percent from the density we will have to work with.

A bag or a drum selected on the basis of the sample supplied may be 20 percent too small. The filling rate can certainly not be slowed down to allow for this settling. We'll have to add 20 percent to the container size; the increased cost *will* show on the cost sheet. What will not show, but is still a part of the true cost of packaging, is the customer's feeling that, because the container is not full, he has been shorted.

Suppose, on the other hand, we recognize this factor in advance. Maybe we can do something about it. The extra cost of a deaerating-type packer would probably be very easily justified by the reduction in container costs. Either way, the cost of packaging is seriously affected.

WILL IT CAKE UNDER PRESSURE?

All these things seem to point to bags as the cheapest and most suitable containers for our product. There are still some other considerations, however, that could make bags a poor choice and a costly error.

Suppose, for instance, this material of ours cakes badly under pressure and causes severe trouble and loss to the customer if not dispersed evenly in his blend or mix. We can't use a bag; we'll

need a drum that doesn't depend on the contents to carry warehouse stacking loads.

Suppose this dry, powdery, dusty stuff happens to be slightly poisonous, either by contact or inhalation. Even if the customer was willing to handle it, maybe we couldn't legally ship it in a bag—we need a drum.

Or suppose this slightly acid material reacts with paper to the point of lost quality. We can line a drum cheaply, even to hold liquids, but lining a bag, closure and all, is a different matter. The bag probably won't do.

Suppose one of these possibilities comes to light after we've made a few deliveries in bags and made our investment in equipment and container inventory. An increase of 200 or 300 percent in estimated packaging cost is not a very pleasant thing; sometimes it can set off unpleasant reactions. Maybe one of your friends will let you know how it came out.

MATCH LABOR AND EQUIPMENT

This discussion, so far, has been on the selection of a suitable container in order to arrive at that part of the cost of packaging. But we can't make our final choice of container until we have considered the packaging equipment and operation.

It's not difficult to take the yearly amortization rate, add to it the operating cost, and divide by the pounds per year to get the cost per pound. The trick is in the selection of the filling equipment most suited to our needs.

About the biggest single factor in selecting packaging equipment is the rate at which we need to fill. Usually the faster the rate required, the more expensive the equipment. That doesn't necessarily mean that the cost of packaging goes up with the cost of faster equipment—it may go down instead.

Let's assume, merely for illustration, that bags were our final choice for the container. We've already pointed out the effect of seasonal requirements so let's consider only year-round production—500,000 lb. per month.

One bag per minute will do it on one shift. It would be easy to get a machine and one operator to do that. But the operator couldn't leave the machine because once every minute he would have to change bags.

Maybe the production step just ahead of packing requires a man to attend the operation full time but actually occupies him only half time. He can't do the packing, because he must work a continuous hour out of every two, and the packer requires attention every minute for most of the shift in order to keep up.

If we select a packer that will fill two bags per minute instead of one and provide a supply hopper that will hold one hour's production, the two jobs can then be combined and we've saved a full-time operator.

The equipment will cost more, but in all probability the cost of packaging will be cheaper. Think what that would mean if it was a three-shift item—three full-time men.

Here's another possibility that might seriously affect our cost. Suppose our particular operation did require a separate packing crew of one or more men on three shifts. A hopper with capacity equal to two shifts' production and a packing setup with capacity three times production rate would save us two complete full-time packaging crews. Our labor costs would drop to one-third.

CONSIDER AUTOMATIC EQUIPMENT

Many times we can get somewhat the same results in labor savings by selecting automatic or semi-automatic packaging equipment. For instance, in filling drums, manual operation would require constant attendance in filling to weight without overflowing, with an additional man to close and stencil. The filling operator actually is idle during most of the material flow time, and except for the responsibility of accurate filling, might easily handle both jobs. Semi-automatic equipment then could possibly cut the labor in half.

Another arrangement of semi-automatic equipment with some labor-saving results might permit the filling operator to handle two or more fillers simultaneously. This, in turn, might permit a more efficient closing and marking operation from the combined output.

Automatic and semi-automatic equipment usually deliver more dependable packing accuracy than manual equipment. This becomes more and more important as labor seems to become less and less willing to be quality conscious. The better accuracy can easily justify the extra cost.

WHAT DOES ACCURACY REALLY COST?

In the same way that equipment costs go up as the rate increases, costs also follow accuracy requirements. The smaller the allowed tolerances, the more expensive the filling equipment.

But here again, although some sacrifice may be required in direct packaging cost as it increases with more expensive equipment, it may be well worth while when compared with the indirect cost of using less accurate equipment.

So another question is in order: What is the plant's policy toward packaging tolerances? This can be a long subject by itself, but we'll limit ourselves here to cause and effect.

Don't be surprised if we happen to find that we really have no established policy and are operating on a "best we can do" basis. That leaves it squarely up to the operating foreman. Guess what his policy will be after he's been raked from stem to stern a few times for underweight and customer complaints. He'll pack just a little heavy—¼ lb., ½ lb., 1 lb. He's giving our product away, and the more inaccurate the filler, the more he plays it safe.

If our product is worth 50 c. per lb. and he plays safe by only ¼ lb., he would be giving away $7,500 worth in a year. That is part of the true cost of packaging, because it is directly dependent on the selection of equipment.

There was one group that prided itself on its established policy of always giving the customer more than he paid for. But when setting up a new line with that policy being strictly adhered to, they found that no matter how expensive the equipment, the most accurate they could get still left them giving away about $30,000 worth of product a year. It did not require another dime of investment to knock that $30,000 a year off the true cost of packaging; a reasonable change in packaging policy did the trick.

These simple illustrations may not not have touched at all on your particular problems. But remember the one thing that is common to all packaging fields: The true costs of packaging represent all the facts. So be sure you have all the facts evaluated before making your final choice of containers, filling equipment and the rest.

Industry Teams Report on A-Power—II

Add these reports to the two in last month's issue to get a good idea of what we can expect from nuclear power for industry within the next few years. This completes the four industry-team reports.

NOTE—This is the second of two articles (Part I, p. 188, July 1953) summarizing recently declassified information on the four industry-team studies of atomic power potentialities. This month we review the reports of the Monsanto Chemical Co.-Union Electric Co. team and the Pacific Gas & Electric Co.-Bechtel Corp. team. In July we had reports of the Commonwealth Edison Co.-Public Service Co. team; and the Dow Chemical Co.-Detroit Edison Co. team.—EDITOR.*

Monsanto-Union Electric Report

As with the other industry-team studies, the Monsanto Chemical Co. and Union Electric Co. contracted to study the economic and engineering feasibility of constructing and operating a privately owned reactor and power plant for producing both plutonium and commercial electric power. Again, the object was to consider a reactor which could be built within the next few years.

The study hinged principally on two reactor types, both of thermal or slow neutron design. Both would use enriched uranium as the fuel, with graphite moderator and sodium cooling. The principal difference, aside from size, lay in the cooling method.

Table I compares the principal characteristics of the two reactors. They are both of the Hanford type with modifications to permit converting the heat to commercially saleable power. Consideration was given to both sodium and sodium-potassium eutectic coolant, but the conclusion was that sodium was the more advantageous despite its higher melting point, owing principally to the possibility of severe interaction between potassium and the graphite of the moderator, as well as the higher absorption cross-section of potassium.

Metallic uranium was chosen for the fuel, with a maximum uranium temperature of 1,100 deg. F. to give some margin of safety below the alpha-beta phase transformation temperature of 1,229 deg. F. The moderator, graphite blocks, would form an octagonal prism 24 ft. high by 35 ft. across the face, and would be surrounded by a 2-ft. thick reflector of graphite. The prism would be provided with cooling channel holes spaced on a square lattice. The tubular fuel elements in these holes would be cooled by sodium flowing through both the fuel elements and the annular space between the walls of the cooling channel and the fuel elements.

The hot sodium would then flow through heat exchangers and be pumped back to the reactor. The whole arrangement of the core and sodium pools would be surrounded by thermal insulation and a suitable water-cooled shield of massive concrete or a mixture of hydrogenous and heavy materials. Both designs provide for retubing of the reactor if required.

Full-load operation calls for frequent replacement of the fuel element assemblies, so the design is such that the fuel elements can be loaded and unloaded while operating at full load. Irradiated fuel assemblies would be stored for several days to allow radioactivity decay sufficient to permit transferring in lead shipping coffins. Operation of all fuel loading and unloading would be by remote control. These studies indicated that the most economical dual-purpose thermal reactor would use enriched fuel which would reduce the cost of plutonium more than enough to pay for the enrichment.

Table I—Characteristics of Sodium-Cooled Graphite Thermal Reactors Considered by Monsanto-Union Electric Team.

	Case A	Case B
Heat output, megawatts	1,000	3,000
Percent enrichment of U-235	0.83	0.95
Quant. uranium, kg	214,000	214,000
Fuel elements	Internally cooled tubes	Internally and externally cooled tubes
Fertile material	U-238	U-238
Max. fuel temp., deg. F	1,100	1,100
Coolant temp. in, deg. F	300	300
Coolant temp. out, deg. F	650	900
Coolant max. vel., fps	20	20
Coolant cfm. at 300 deg. F	9,000	16,000
Pumping power, kw	3,000	5,000
Costs*		
Capital cost, $ million	26	44
Net power output, kw	210,000	554,000
Invest., $/kw	124	110
Power cost, mills/kwh	4.13	3.73

* Power cost assumes plutonium sales offset actual fuel cost. Comparable costs for a modern coal-fired plant are: $44 million for 260,000-kw. plant with cost of $169/kw., giving 3.97 mills/kwh. power cost

POWER PLANT

Heat exchangers for transferring the reactor-generated heat from the sodium to water for steam generation would have to be of special construction to prevent accidental contact of sodium and water. The heat exchangers would be a shell-and-tube type with double concentric tubes to provide a barrier space between the two mediums. This barrier space would be filled with mercury to give good heat transfer and would be provided with a leak-detection system to warn of tube failure on either side. Safety and radioactivity hazards require that the entire sodium circuit be leak-tight which means that normal type glands or packing on valve stems and pump shafts are totally unacceptable. A double-bellows seal for valve stems with a leak detector between the bellows is satisfactory. Unfortunately, the only absolutely leak-proof pump is the electromagnetic type which is of low efficiency. Fifteen such pumps (plus spares)

*A sub-committee of the A. E. C.'s Advisory Committee on Industrial Information, consisting of Andrew W. Kramer of Power Engineering magazine, and Stanley A. Tucker of the A. S. M. E., prepared the declassified versions of the original industry-team reports. These represented above one-quarter to one-third of the bulk of the original material. As presented here, the declassified versions are further condensed to about one-quarter of the material released on May 31 by the A. E. C.

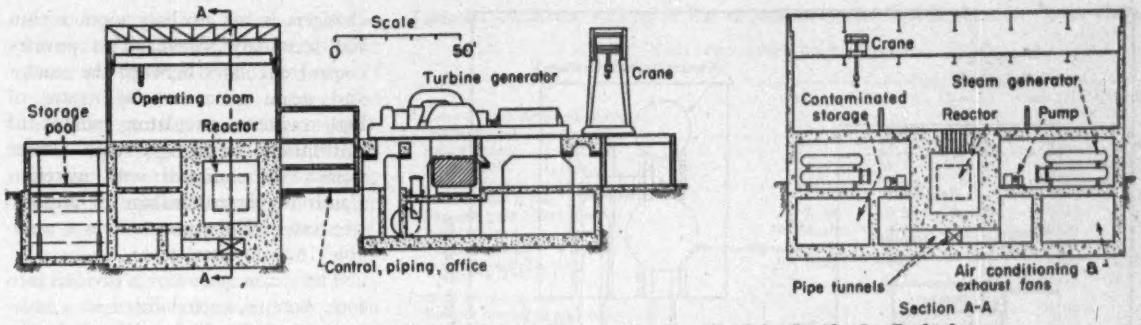


Fig. 1—Reactor and power plant of water-cooled, deuterium-moderated type, considered by Pacific Gas-Bechtel team.

would be necessary for the handling of the total sodium flow.

The first reactor considered would have a heat output of 1,000 megawatts, while the second would be of three times that size. Concerning the first, sodium would leave the reactor at 650 deg. F., and return at 300 deg. The heat exchangers would produce turbine throttle steam at 150 psia. dry and saturated, at the rate of 3 million lb. per hour. A thermal efficiency of the turbine cycle of about 22 percent would give a gross output of about 220,000 kw. from two 110,000 kw. turbo-generator units. Auxiliary power would consume about 5.5 percent of the gross capability. Control by steam throttling would be impractical and a separate dump steam condenser would be provided with a capacity equal to the entire heat output of the reactor. With a suitable bypass arrangement, a certain degree of turbine load control would then be possible by starving the turbine of steam.

For the second reactor, with a total heat output of 3,000 megawatts, sodium would leave the reactor at 900 deg. F. and return at 300 deg. F. In this case steam would be produced at 400 psia, and 746 deg. F., exhausting from the turbine to the condenser at 1.5 in. Hg to produce a gross electrical output of 878,000 kw. from five turbo-generator units. The steam would be generated at the rate of approximately 8.8 million lb. per hour, and the turbine cycle efficiency would be about 28 percent. Auxiliary power would consume about 5 percent of the gross capability.

A variation considered for this reactor, involving dumping of the heat in the range from 300 to 500 deg. F., would give a more marketable quantity of power. It would produce 4.8 million lb. of steam per hour at the same cycle efficiency, resulting in 579,000 kw. gross output from three turbo-generator units.

This study was based on the use of the reactor for a five-year period to produce plutonium. After the end of the five-year period, several courses would be possible. One would be to continue operating the reactor to produce heat for steam and thus to generate electricity. The cost of electricity from such a source might still be about as high as that from conventional fuel-burning plants, even though the equipment would be fully amortized. It would also be possible to shut down the reactor and run the power plant by adding a modern high-pressure boiler or a boiler and high-pressure topping unit.

In studying the costs of power production by these two reactors, in comparison with a modern coal-fired plant (see Table I), it became apparent that with a dual-purpose reactor the cost of heat should be borne by the plutonium. Thus the actual heat in the steam could be considered free. However, even with free steam, the cost of electric power from a reactor is very close to that of a modern coal-burning plant. Furthermore, the depreciation charges with the five-year amortization period are so high as approximately to offset the savings in fuel costs.

The study also considered the problem of safety. It was concluded that power-generating reactors would present no significant hazard to the general public and that designs should be evolved which would require exclusion areas very much smaller than those set up for Hanford type reactors by the Reactor Safeguard Committee.

Concerning developmental problems, the study concluded that the design changes and problems to be met in adapting the Hanford type reactor to dual-purpose operation would probably require a chain-reacting model or pilot plant. There are many problems still unanswered, among them the question of the reaction between sodium and graphite under reactor conditions. Other important problems involve the actual graphite temperature, the possibility of carburization and embrittlement of the thin cooling-channel tubes, and the effect of expansion of the graphite with increased temperature.

Pacific Gas-Bechtel Report

This team based its study primarily on two reactor types, a water-cooled, natural-uranium reactor, and a liquid-metal-cooled fast reactor which could be used either as a breeder or as a converter. The study concluded that the design and construction of reactors to produce both fissionable material and power is now technically feasible. The water-cooled thermal type of reactor has now reached the stage of engineering development where costs can be predicted with a fair degree of accuracy. For plutonium production at the earliest possible date and for a definite production period, this type of reactor would be very attractive. On the other hand, the liquid-metal-cooled fast reactor would be more suitable from the high-pressure, high-temperature power plant standpoint, it would conserve the existing supply of uranium, and hence is more attractive eventually for power production purposes.

The study concluded that the sale of power from a dual-purpose reactor would not cut the cost of plutonium substantially but, at least, that the sale of power would justify the cost of

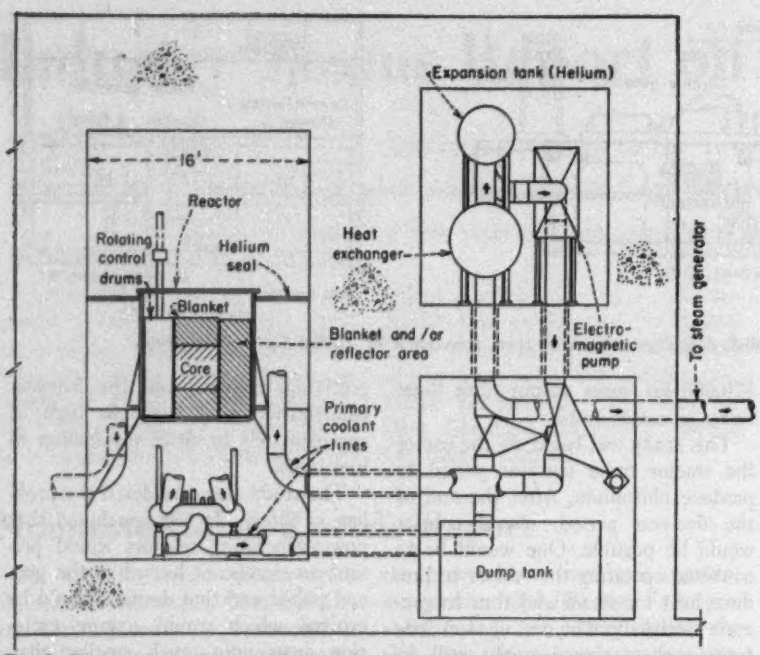


Fig. 2—Fast reactor and intermediate exchanger considered by Pacific Gas-Bechtel team as suitable for longer-range development and construction.

power generation equipment. It would therefore seem that dual-purpose reactors can be justified economically at present, under present plutonium demand and cost conditions, and that such reactors would have a continuing economic value solely as power producers after plutonium demand ceased.

One of the first matters considered by the Pacific Gas-Bechtel team was reactor safety. It was concluded that a reactor catastrophy would be a cooling failure or a run-away of the reactor, resulting in possible release of radioactive and toxic gases. This gas release should not occur with explosive violence. The conclusion was that any such release of gases would be retained largely within the shield area and in the essentially air-tight building. Therefore, public hazard could be controlled primarily by reactor and reactor-building design, and a high degree of isolation would be unnecessary.

After surveying the various A. E. C. reactor designs, the team decided to concentrate principally on two, including a light-water-cooled deuterium-moderated reactor (Fig. 1), and a fast breeder as proposed by the Knolls Atomic Power Laboratory (Fig. 2). The first would have immediate technical feasibility, and the other more development problems but greater promise as a future power reactor because of its ability to breed new fissionable material and operate at high temperatures. Characteristics of the two designs are given in Table II.

THERMAL REACTOR

A preliminary design of a water-cooled natural-uranium reactor was worked out in sufficient detail to permit cost estimates and determine the directions in which detailed development would be necessary. Essentially, the reactor consists of an aluminum tank containing a multiplicity of aluminum tubes between tube sheets, serving as the container of the moderating heavy water. The fuel is placed in pressure tubes which extend through the core tank concentric to the aluminum tubes. Light water, the primary coolant, flows through these pressure tubes. The flow is arranged so that the water flows first through the center portion of the core, then down through the outside pressure tubes into an outlet header.

The reflector consists of an annulus of demineralized light water 1 ft. thick, surrounding the core tank, and 1 ft. of heavy water across the top and bottom of the core tank. The light water is contained in several segmental tanks, the space between them being occupied by control plates. This water is circulated through heat exchangers in an auxiliary room within the secondary shield. The primary coolant circulates between the reactor and steam generators by means of high capacity circulating pumps of conventional centrifugal type. These pumps are equipped with injection glands to prevent leakage of radioactive water. The piping system is weldable 18-8 stainless steel.

The steam generator is divided into four sections, each located in a separate shielded cubicle adjacent to the reactor. The drum and shell side of each steam generator are fabricated of carbon steel for a 250 psig. operating pressure. The tube side, however, must be of stainless steel for operation at 1,100 psig. and 600 deg. F. The cooling system for the deuterium moderator handles 7½ percent of the total heat output of the reactor, cooling the D_2O from 180 to 120 deg. F. The unit requires something like 80,000 lb. of D_2O which must be handled with pumps of essentially zero leakage. Aluminum is the material of the moderator piping system.

Reactor control is effected by plates which occupy aluminum sheaths between tubes around the periphery of the core tank. These are withdrawn by a servomotor and released automatically to fall in place within the sheath in the event of an emergency shut-down.

The steam produced by the steam generators is supplied to a single 125,000-kw. turbo-generator. Auxiliary power comes either from the generator or from a transmission line, with emergency power supplied by a battery and engine-driven generator.

Reactor operating personnel would be comparatively numerous for the first dual-purpose reactor. The total for all shifts would amount to 103 men for the reactor plant, and 14 men for the power plant. One reason for the large number of personnel is that in a dual-purpose plant, the specifications for the fissionable material produced limit the allowable radiation exposure of uranium and require the fuel to be removed much more frequently than the demands of a power-producing plant alone would dictate. The entire reactor charge would have to be replaced several times per year.

FAST REACTOR

The team concluded that a fast reactor would not only have advantages

for dual-purpose use, but it would also have considerable promise for ultimate power production alone. This type of reactor differs from the water-cooled thermal reactor in several respects. Since it employs fast neutrons, there can be no materials of low atomic weight to moderate or slow down the neutrons. Water cooling is precluded, therefore, and low-pressure liquid-metal cooling is indicated. In addition, since all materials have much less tendency to absorb neutrons at fast energy levels, the choice of structural materials would be less limited. Stainless steel appears to be entirely suitable for such a reactor. Also there is the obvious advantage that the fast breeder produces more fissionable material than it consumes.

The design arrived at employs a reactor core of highly enriched material surrounded by a breeder blanket composed of either depleted or natural uranium. More than 90 percent of the heat production takes place in the core. The latter consists of an assembly of a large number of stainless fuel elements. A reflector probably would envelope the core, serving to decrease the critical mass, and also to limit heating outside the core. All of this would be contained in a cylindrical steel vessel approximately 8 ft. in diameter and 8 ft. high. Provision would be made to circulate liquid sodium, to permit refueling and to allow control.

Heat would be removed from the reactor core and blanket by liquid sodium flowing at about 30 ft. per sec. Circulation would be maintained by two electromagnetic pumps which would pump the primary coolant to two intermediate heat exchangers, entering at 900 and returning to the reactor at 600 deg. F. Heat would be transferred from the primary coolant to an intermediate coolant, also sodium. This intermediate coolant would be circulated by electromagnetic pumps to the steam generators at 850 deg. F. where it would produce superheated steam at 500 psig. and 750 deg. F. There would be two steam generators, each producing 800,000 lb. per hour. The steam would be delivered to a single large 154,600-kw. turbo-generator operating on a conventional regenerative cycle.

Control can be affected either by moving a reflector located between the core and the blanket, or by altering the disposition of fertile and fissionable materials. Either method can be accomplished by the use of control drums incorporating in their most reactive position all the elements of the normal blanket (and reflector). Another possibility is the use of a movable reflector outside the core which can be raised or lowered to change the reactivity. A control of this type is in operation in the experimental breeder reactor at the National Reactor Testing Station in Idaho.

Refueling a liquid-sodium-cooled reactor is complicated by the requirement that an atmosphere of inert gas (probably helium) must be maintained over the sodium surface at all times. Complete refueling of the core and the inner portion of the breeder blanket would be required once a year. If the reactor is operating as a converter, the U-235 remaining in the core must be decontaminated and reprocessed. If it is operating as a breeder, a portion of the separated and decontaminated plutonium must be reprocessed to make up a future core. Refueling would involve complete replacement of core fuel elements and as much of the blanket as might be necessary to maintain reactivity control. Therefore, it would seem that about one month would have to be provided for scheduled maintenance and refueling out of each year, allowing a conservative forecast of an 80 percent annual capacity factor.

There would seem to be little doubt that operation of the fast reactor would be more economical as a converter for a considerable period of time because of the high value of plutonium. Then, in changing to the breeder cycle, the handling of plutonium could still be avoided by substituting U-233 and thorium. An additional two years would probably be required to complete a fast reactor installation compared with a thermal type. On the other hand, the fast reactor has an outstanding advantage in the possibility of improved steam conditions. Where the present design contemplates a steam temperature of 750 deg. F. it appears entirely feasible that coolant temperatures can be in-

Table II—Design, Operating and Cost Data for Dual-Purpose Reactors Considered by Pacific Gas-Bechtel Team.

	Water-Cooled Thermal Reactor	Sodium-Cooled Fast Reactor
Heat output, megawatts	500	500
Net electric power, megawatts	100.6	145.3
Fuel	Nat. U, 60 tons	U-235
Fertile materials	.....	U-238
Core size	13.2 ft. diam x 11 ft. high	38 in. diam x 38 in. high
Moderator	D_2O	None
Reflector	H_2O	Pb
Shield	Concrete	Concrete
Primary coolant in, deg. F	384	600
Primary coolant out, deg. F	500	900
Sec. coolant in, deg. F	.....	550
Sec. coolant out, deg. F	.....	850
Steam pressure, psig	160	485
Steam temp., deg. F	378	750
Costs, $ total	41,000,000	51,000,000
Improved site, $	2,800,000	2,800,000
Total reactor, $	24,350,000	33,100,000
Total turbo-gen. plant, $	12,650,000	13,600,000
Step-up facilities, $	1,200,000	1,500,000

Table III—Economic Aspects of Use of Sodium-Cooled Fast Reactor for Power Only.*

(Data in parentheses are mills/kwh.)

	Cost, $ Million				
	Case A	Case I	Case II	Case III	Case B
Reactor and power-plant capital:					
Site and yard improvement	2.8	2.8	2.8	1.1	0.5
Reactor plant	33.1	33.1	33.1	16.6	
Power plant	15.1	15.1	15.1	12.1	13.5
Total capital	51.0	51.0	51.0	29.8	14.0
Annual capital costs:					
Site and yard improvement	0.36	0.36		0.15	
Reactor plant	4.50	4.50		2.26	
Power plant	2.05	2.05		1.65	
Total fixed charges	6.91	6.91		4.06	1.90
		(6.3)		(3.6)	(2.9)
Annual operating costs:					
Reactor operation and maint	1.06	0.74	0.74	0.37	
Power-plant operation and maint	0.46	0.46	0.46	0.35	
Total operating cost	1.52	1.20	1.20	0.72	0.40
		(1.2)	(1.2)	(0.6)	(0.6)
Annual fuel costs:					
Fuel (incl. inventory) and chemical processing	10.38	4.60	2.50	1.50	1.67
Total fuel cost		(4.5)	(2.4)	(1.3)	(2.5)
Cost of power:					
Total annual costs	18.81	12.71	3.70	6.28	4.00
Net capacity, megawatts	145.0	145.0	145.0	160.0	100.0
Net output, million kwh	1,020.0	1,020.0	1,020.0	1,120.0	667.0
Cost, mills/kwh		(12.5)	(3.6)	(5.5)	(6.0)

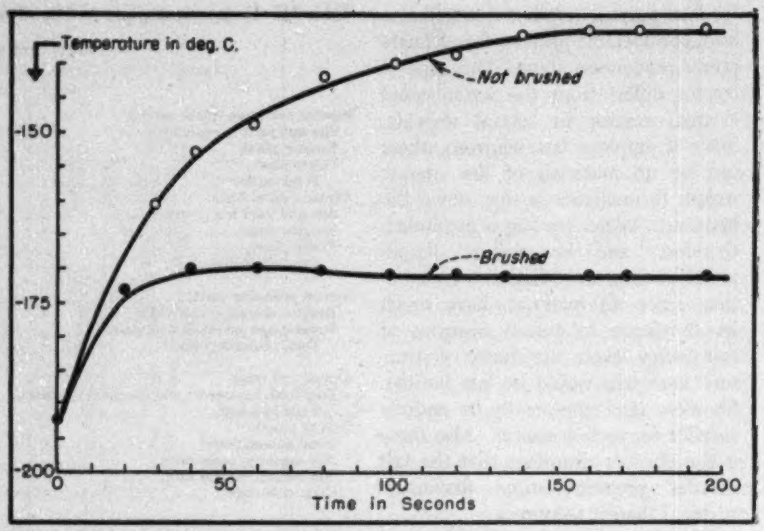
* Cases A, I and II based on current conceptions of dual-purpose reactors. Case A, operation for power and plutonium. Case I, operation for power only. Case II, operation for power only after 5-yr. amort. Case III, future improved reactor for power only. Case B, conventional steam-power plant.

creased to a point where steam at 1,000 deg. F. could be obtained.

Table II gives an estimate of capital cost for each of the two reactors considered here, exclusive of fuel fabrication at chemical plant facilities. These costs represent money to be appropriated by the owner of the project, and are arrived at in the same manner as for a conventional steam plant designed and constructed by a contractor for a private utility. Further estimates of annual operating cost indicate that the cost for the thermal reactor would be in the neighborhood of $1,580,000, compared with $1,520,000 for the fast reactor. Neither includes any fuel cost.

Table III gives a summary of three brief cost studies based on the liquid-metal-cooled fast reactor operated for power alone. Case (1) represents this reactor operated as a power reactor and gives an indication of the current cost of producing atomic power. Case (2) represents the operation of the same reactor for power only, after complete amortization. Case (3) represents the costs which might be associated with a similar reactor improved as might be possible in the future. For comparison Case (A) deals with operation of the reactor for its primary purpose of producing power and plutonium together, while Case (B) shows costs associated with a conventional steam power plant.

These estimates are based on an amortization period of 20 years for both atomic power plants and fuel fabrication plants, and a capacity factor of 80 percent. Examination of the data in Table III indicates (Case 1) that atomic power from an immediately feasible nuclear power plant cannot compete with power from conventional steam plants now being constructed. Even with an amortization period of 20 years, the cost of such atomic power would be of the order of 12.5 mills per kwh. A conventional steam plant would produce such power at 6 mills per kwh. However, Case (2) (completely amortized plant) shows power cost down to 3.6 mills and indicates that such a plant would have a substantial value as a power producer after retirement from plutonium production. Case (3), an assumed future atomic plant, might immediately produce power on a basis competitive with conventional methods.



DATA from typical test in which solid CO_2 was deposited on the cold surface.

How Solid Deposits

JAMES A. TAYLOR

In many processes a solid material is condensed from a gas or vapor in such a way that the solid is deposited on the heat-transfer surface. The solid layer builds up and tends to slow down further cooling because of its insulating effect.

Such a problem is encountered in the sublimation of materials like phthalic anhydride, naphthalene, anthracene, iodine, arsenic compounds, ice and carbon dioxide. There are many other materials which sometimes offer the same problem; often the solid is cooled or laid down in the presence of a noncondensable gas, such as air or nitrogen.

In most problems of cooling with sublimation the velocity of the gas phase is not very high. This aggravates the problem, since the heat transfer through a gas film such as air is of the order of 10 to 20 Btu. per (hr.)(deg. F.)(sq. ft. of heat-transfer surface). Even these poor values are quite good compared with the heat-transfer rate that occurs when a snow-like insulating layer of such a material as carbon dioxide or phthalic anhydride is formed on the heat-transfer surface. As the layer builds up in thickness, the heat-transfer rate approaches a very low value, so that exceedingly large heat-transfer surfaces are needed if the process is to be continuous.

There are two solutions to this problem: (1) Increase the velocity of the gas to the point where the sublimate will be knocked off or dislodged; (2) brush or scrape away the solid material as fast as it is deposited.

The information presented here shows a comparison of the heat transfer obtained both with and without brushing during solid deposition on the heat-transfer surface. It is part of a master's thesis by W. L. Anderson, who held a Shell Oil Co. fellowship under the direction of the author at the University of Alberta.

The sublimate was obtained by cooling a dry mixture of carbon dioxide and air in a test tube partially submerged in liquid air or liquid oxygen. The test tube was 1¼ in. diameter by 12 in. long and was equipped with a nylon-bristled test-tube brush connected through a packing gland to a motor which ran at 850 rpm.

SUBLIMATION TEST RESULTS

The type of heat transfer that occurs when a solid material like carbon

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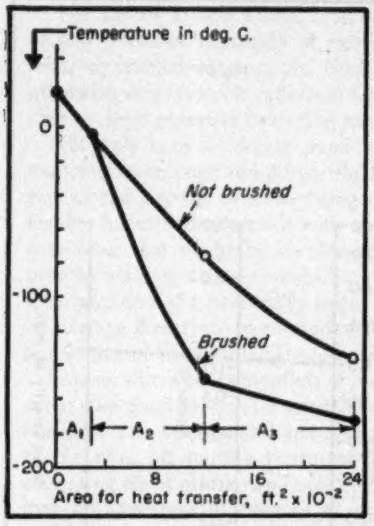
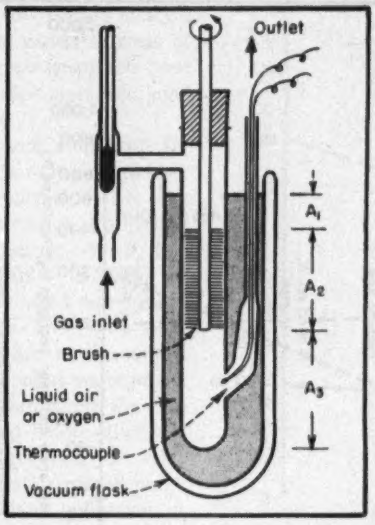


BRUSHING ups the heat-transfer rate.



APPARATUS used in getting the data.

Affect Heat Transfer

dioxide snow is deposited on the heat-transfer surface is shown in the accompanying graphs. In the first graph, temperature of the gas at the outlet of the apparatus vs. time in seconds is plotted for a rate of 17.7 cu. ft. per hr., with 4.83 percent carbon dioxide in the air entering the test apparatus.

The effect of brushing away the deposit as fast as it is formed is also indicated in this graph. With the brush in place but not turning, it takes about 140 sec. to reach a steady state of poor heat transfer. The coefficient is about 2.3 Btu. per (hr.) (sq. ft.) (deg. F.). When the deposit is being constantly brushed away it requires about 40 sec. to reach a steady state, with a heat-transfer coefficient of about 6.5. As the brushing continues and some snow accumulates in the brush, the values improve a small amount. The conductivity of the film actually removed by the brush is calculated to be about 3.6 Btu. per (hr.) (sq. ft.) (deg. F.) in this case.

An analysis of these two tests after a 200-sec. interval, showing calculated temperature drops from the inlet of the tube to the outlet, assuming that log-mean values can be used, is shown in the second graph. This shows that brushing is quite effective in improving heat transfer.

The concentration of carbon dioxide was varied from 4.83 percent to 39.5 percent. In general, heat transfer improved considerably with the increase of the concentration of the subliming gas. With a constant flow rate of 17.7 cu. ft. per hr. and with brushing, a heat-transfer coefficient of 6.45 was obtained when the concentration was 4.83 percent. At 16.9 percent CO_2 the coefficient was 9.5, and at 39.5 percent CO_2 the coefficient was 16.7. Without brushing, for the same concentrations in the same order and with the same flow rate, coefficients of 2.3, 3.18 and 4.51 were obtained.

The effect of flow rate was studied only in the intermediate concentrations. In general, increasing flow rate improved the heat transfer when the deposit was formed without brushing. This is to be expected and is explained by the increased turbulence due to higher velocities. On the other hand, with brushing there is no definite correlation between the flow rate and the heat-transfer rate. Apparently flow rate has little effect on the brushed process.

Test Data on Carbon Dioxide

Test conditions: Apparatus immersed in liquid air or oxygen. Temperatures taken at 200 sec. Motor speed held constant at 850 rpm. during brushing.

Condition of Surface	CO_2 Mole %	Temperature, Deg. C. Inlet	Outlet	Bath	Flow Rate, Cu. Ft./Hr. at 1 Atm.	Heat-Transfer Coefficient*	Conductivity Coefficient of Film Removed*
Brushed.....	4.83	21.0	−172.0	−192.5	17.7	6.45	3.67
Not brushed..	4.83	21.0	−137.5	−192.5	17.7	2.30	
Brushed.....	11.4	23.0	−183.5	−185.0	12.3	11.9	3.68
Not brushed..	11.4	23.0	−154.5	−185.0	12.3	2.74	
Brushed.....	11.4	23.0	−170.0	−185.0	17.7	10.0	4.43
Not brushed..	11.4	23.0	−134.0	−185.0	17.7	3.07	
Brushed.....	11.4	23.1	−177.0	−185.0	27.6	10.7	5.03
Not brushed..	11.4	23.1	−103.0	−185.0	27.6	3.42	
Brushed.....	13.4	23.0	−173.5	−185.0	12.3	8.02	3.39
Not brushed..	13.4	23.0	−139.0	−185.0	12.3	2.38	
Brushed.....	13.4	23.0	−159.0	−185.0	17.7	8.35	4.63
Not brushed..	13.4	23.1	−126.0	−185.0	17.7	2.98	
Brushed.....	13.4	23.1	−146.0	−185.0	27.6	10.9	6.33
Not brushed..	13.4	23.0	−110.5	−185.0	27.6	4.00	
Brushed.....	16.9	22.0	−173.0	−185.0	12.3	9.07	3.56
Not brushed..	16.9	22.0	−136.0	−185.0	12.3	2.56	
Brushed.....	16.9	25.0	−158.5	−185.0	17.7	9.50	4.78
Not brushed..	16.9	25.0	−121.0	−185.0	17.7	3.18	
Brushed.....	16.9	25.1	−145.0	−185.0	27.6	13.5	6.42
Not brushed..	16.9	25.1	−106.5	−185.0	27.6	4.35	
Brushed.....	16.9	25.0	−132.0	−185.0	32.2	13.0	7.52
Not brushed..	16.9	25.0	−101.0	−185.0	32.2	4.75	
Brushed.....	39.5	22.5	−164.0	−192.5	17.7	16.7	6.17
Not brushed..	39.5	22.5	−108.5	−192.5	17.7	4.51	

* Expressed in Btu./(hr.) (sq. ft.) (deg. F.)

CONCLUSIONS

1. Brushing away the solid deposit as fast as it is formed improves the rate of heat transfer. The deposit that is brushed away has an average conductivity value between 3 and 8 Btu. per (hr.) (sq. ft.) (deg. F.) in the experiments reported.

2. Heat transfer is considerably improved as concentration of the subliming material (carbon dioxide) increases and the noncondensable gas (air) decreases.

3. For a carbon dioxide-air mixture with 16.9 percent carbon dioxide (similar to a flue gas), heat-transfer values between 9 and 13.5 Btu. per (hr.) (sq. ft.) (deg. F.) can be obtained with brushing. Similar values obtained without brushing are from 2.5 to 5.

These results indicate that a pure vapor would give the best results for sublimation, and if the noncondensable gas was a better heat conductor, such as hydrogen, the results probably would be improved.

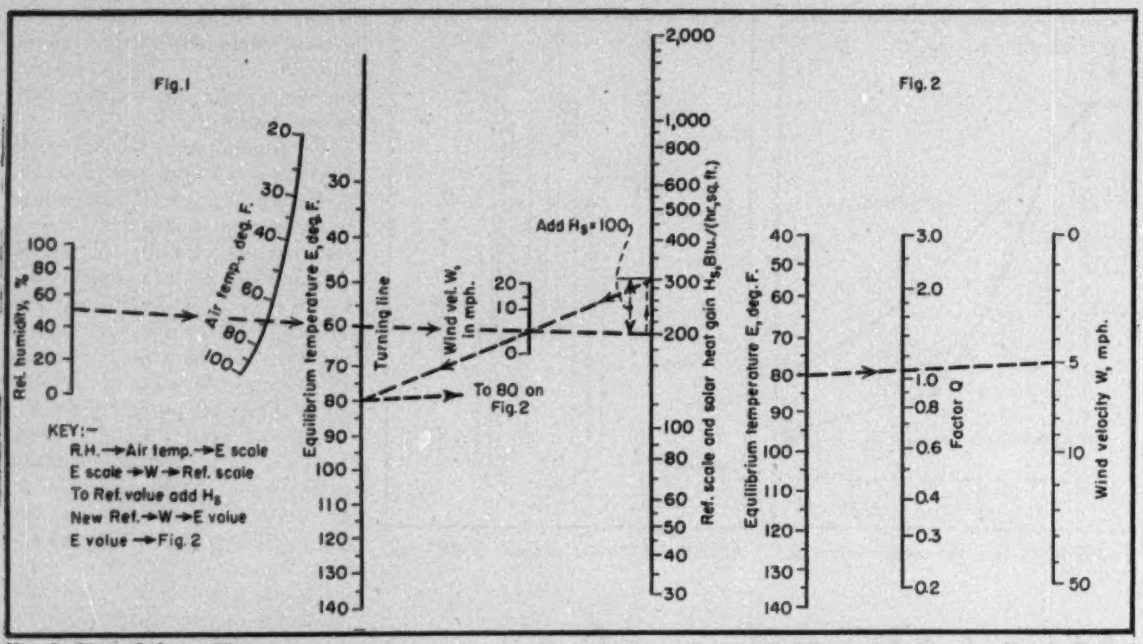


Fig. 1
Rel. humidity, %
Air temp., deg. F.
Equilibrium temperature E, deg. F.
Turning line
Wind vel. W, in mph.
Add H_s = 100
To 80 on Fig. 2
Ref. scale and solar heat gain H_s, Btu./(hr.,sq. ft.)
KEY:—
R.H. → Air temp. → E scale
E scale → W → Ref. scale
To Ref. value add H_s
New Ref. → W → E value
E value → Fig. 2
Fig. 2
Equilibrium temperature E, deg. F.
Factor Q
Wind velocity W, mph.

Fig. 1—Chart finds equilibrium temperature of pond for various conditions of relative humidity, wind velocity and solar radiation.

Fig. 2—Q factor found here applies to all pond conditions. Use with appropriate multiplier.

Cooling Pond May Answer Your Water Cooling Problem

Cooling ponds seem to find much less use than their abilities warrant. One reason lies in the earlier lack of data on which to design them. Here are their advantages, plus simple design charts.

J. W. LANGHAAR

Plant site selection and development for chemical and power industries are both greatly affected by the availability of water for process cooling and waste disposal. When a plant is located on a large enough river, once-through river-water cooling is generally used. But if the plant is some distance from a river, or is in an area of limited water supply, then a recirculating system may be preferable. Cooling towers have been thoroughly studied for this purpose, but there has not been adequate information on the design and performance of cooling ponds.

A few years ago I undertook an evaluation of the different methods of providing water, as part of a plant survey program. When it became apparent that there was insufficient information on cooling ponds, I assembled reported experimental data of a general nature in a way that would be useful in estimating the pond area needed for any particular set of weather conditions and water temperature, for uniform flow through the pond. A pond was available for checking the theory under summer conditions. This pond, about 700 ft. wide, 4,000 ft. long and 5 ft. deep, had a flow of about 20,000 gpm. There was close agreement between the observed and predicted temperatures at different locations along its length.

With sufficiently impervious soil in a flat area, a pond may be constructed at relatively small cost by pushing up an earth dike 6-10 ft. high. As water flows through the pond it is cooled largely by evaporation, and sometimes to an appreciable extent also by convection and radiation. A new pond can be designed for a reasonably uniform flow, although in natural ponds of irregular shape there may be a significant departure.

Cooling ponds may well be more economical than other methods of supplying cooling water to plants more than 2,000 to 3,000 ft. from a river, where a temperature 3-4 deg. F. above river temperature is acceptable and where the terrain is suitable. In addition, cooling ponds offer other advantages that are sometimes important.

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The use of a recirculating system will permit location of new plants or expansion of existing plants in areas of relatively limited water supply. Such areas frequently have otherwise very favorable industrial features; moreover, good sites on large rivers are becoming scarce.

Not only does a cooling pond require a makeup for evaporation, seepage and purge which is only a small fraction of the amount of water being circulated, but it may operate for extended periods with no makeup. For design conditions that might be considered average, one to two months without makeup would be possible. Thus, the industrialization of a river valley might be based more nearly on average flow than on minimum flow. Even with wells as a source of water, there is some variation in the supply.

In cases where contamination of the cooling water might occur, the pond serves as a retention basin where the contaminant can be detected and removed before discharge to the river. If routine treatment is required, the concentrating effect of the pond and the relatively small purge may be advantageous because of the large reduction in quantity of water to be treated.

With once-through river water a large heat load added to the river could adversely affect the plant and animal life, or make the water less suitable for downstream consumers. A cooling pond avoids this problem.

Of the few articles previously appearing on the subject of pond performance, perhaps the most useful has been that by R. F. Throne, "How to Predict Lake Cooling Action" (*Power*, Sept. 1951). However, a generality which permits study of transient or extreme conditions, or analysis of the effect of various weather factors, has been lacking.

Numerous requests for such information led me to extend the original results and to prepare nomograms for determining the required size of cooling pond for a specified cooling load under any given atmospheric conditions. Since at best only an approximation is required or possible, this method does not attempt to include a number of minor factors theoretically involved, nor to ascribe a high degree of accuracy to the experimental data used as a basis.

The data and charts may be applied to problems other than calculating the performance of recirculating cooling ponds. Such problems include for example determination of the temperature at which a body of water will be in equilibrium with the atmosphere, the rate at which a cool body of water will warm up, and the time or distance required for a given temperature change in a river or stream.

USING THE CHARTS

Under given atmospheric conditions a body of water will eventually come to a temperature at which heat loss will equal heat gain. This temperature, referred to as equilibrium temperature and designated as E, may be calculated as shown later. It is, however, greatly affected by the amount of solar radiation, which is usually not known very accurately and which varies throughout the day. If the pond has at least a 24-hr. holdup, then daily average weather conditions may be used and for practical purposes E should be taken as equal to normal river water or lake temperature for the specified weather conditions. The use of average conditions is not strictly correct, primarily because evaporation is not a linear function of temperature, but the error introduced in this manner is small enough to be neglected.

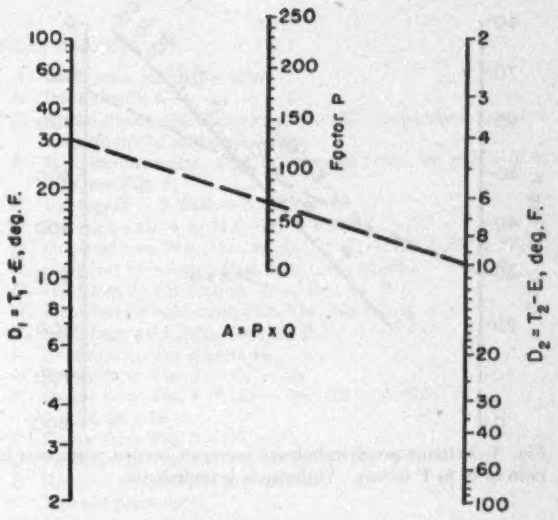


Fig. 3—Uniform-flow pond, where water is to be cooled, is calculated with P factor from this chart.

A pond of infinite size would be required for warm water to cool to the equilibrium temperature. Usually an approach of 3-4 deg. F. is the lowest practicable in a pond of reasonable size. Thus, a pond may operate with a discharge temperature 3-4 deg. F. higher than the normal river temperature. Just as river temperature varies slightly from day to night, so does that of a pond, the amount depending on pond depth. For a pond having more than one day's holdup, the discharge temperature may be expected to vary from average by ± 2 deg. F. for a 5-ft. depth, or ± 3 deg. F. for a 3-ft. depth.

The area of pond required for a given cooling load is practically independent of pond depth. A depth of at least 3 ft. appears advisable, however, to prevent excessive channeling of flow with ponds having irregular bottoms and to avoid large day-to-night changes in outlet temperature.

The factors considered to affect pond performance are air temperature, relative humidity, wind speed, and amount of sunshine. Methods of heat loss and gain include evaporation, convection, radiation and solar heat gain. Items appearing to have only a minor effect and neglected here include heat transfer between the earth and the pond, changing temperature and humidity of the air as it traverses the water, and rain.

The equilibrium temperature E may be assumed equal to the normal river water temperature under given atmospheric conditions, or it may be determined from Fig. 1. For example, assume relative humidity at 50 percent, air temperature at 68 deg. F., wind velocity at 5 mph. and solar heat gain H, at 100 Btu./(hr., sq. ft.). Following through on Fig. 1 according to the key shows E to be equal to 80 deg. F. This E value is then transferred to Fig. 2 for determining Q.

The required cooling pond area may now be estimated from Figs. 2 and 3 as the product of factors P and Q. Fig. 2 gives the Q factor, later developed in Eq. (10), from the values of E and the wind velocity W. Fig. 3 gives the P factor, also from Eq. (10). Here D_1 and D_2 are the approaches to equilibrium for the entering and

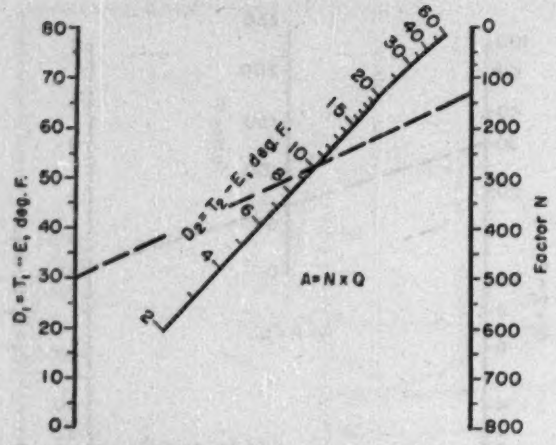


Fig. 4—Extreme pond turbulence increases needed pond area in ratio of N to P factors. Turbulence is undesirable.

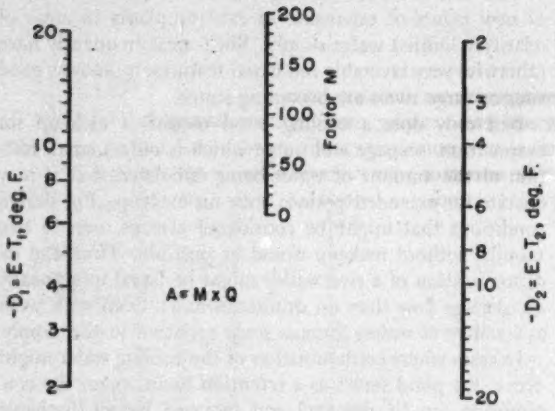


Fig. 5—Uniform-flow pond, where water is to be warmed, is calculated with M factor from this chart.

leaving water, respectively. The P factor assumes a pond with uniform flow, without turbulence, and with the water warmer than the air. As shown later, Figs. 4 and 5 give other factors for other pond conditions.

The pond area $A = P \times Q$, in sq. ft. per gpm. of flow. For example, if the flow rate is 10,000 gpm. and the water is to be cooled from 110 to 90 deg. F., with E at 80 deg. F. and W at 5 mph., then $Q = 1.07$ from Fig. 2. The approaches are $D_1 = 110 - 80 = 30$, and $D_2 = 90 - 80 = 10$. From Fig. 3, $P = 68$. Hence $A = 68 \times 1.07 = 73$ sq. ft. per gpm., and total area $= 10{,}000 \times 73 = 730{,}000$ sq. ft. $= 17$ acres.

With a depth of 5 ft., the total volume of the pond would amount to about 46 hr. holdup, which is more than the 24-hr. holdup required to maintain a fairly constant discharge temperature throughout the day.

Known stagnant portions of a pond should not be included as part of the cooling surface. Also if there is reason to expect channeling of flow, undue mixing, sheltered location, or other peculiarities, an allowance of 10 to 20 percent might be added to the calculated pond area.

In some cases, as with small or irregular ponds, the advantage of uniform flow may be lost to a considerable degree. In order to show the value of uniform flow and to provide data for predicting performance of a turbulent pond, Fig. 4 is given for the extreme condition of the entire pond being at its discharge temperature. If this were the case, the temperature difference between water and air would be less and a larger pond area would be needed. The condition is that solved in Eq. (12) which shows factor Q (from Eq. 10 and Fig. 2) multiplied by a new factor N. Area A is then the product of $N \times Q$, where N is taken from Fig. 4. As an example, using the same conditions as before, but assuming complete turbulence, Q remains at 1.07, N is 130 and A becomes 139 sq. ft. per gpm., or a total of 32 acres, rather than 17. If the area were left at 17 acres and T_2 remained at 110 deg. F., then the discharge temperature would be 95 rather than 90 deg. F.

If warming of the water is desired, in cases where the water is cooler than the air, then the situation is given in Eq. (11), provided that V_w is greater than V_a, so that condensation does not occur. Then $A = M \times Q$ where Q as before is from Fig. 2, and M is taken from Fig. 5.

The later discussion presents data for solar radiation. However, the following summer values may be used for eastern United States in determining E from Fig. 1:

	Solar Radiation H_s, Btu./(hr., sq. ft.)
Clear day maximum at noon	320
Clear day maximum 24-hr. avg.	110
Normal monthly avg. (summer)	75

Even on cloudless days the actual radiation is usually smaller than the indicated maximum values, probably due mainly to reduction of infrared transmission by water vapor in the atmosphere. Furthermore, smoke and dust in industrial areas may reduce solar radiation by 30-40 percent.

The values of E found from Fig. 1 appear to be high by about 2-3 deg. F. This causes the calculated pond discharge temperature to be high by about the same amount. However, this is on the safe side; since the variability of the estimate may be that large, therefore no adjustment has been made.

Necessarily the experimental verification of the equations and charts given here has been limited. There would be special interest in performance data on ponds operating at temperatures much above 100 deg. F., and in further tests of the accuracy of Fig. 1. It is hoped that others will carry the study further.

DEVELOPING THE EQUATIONS

The necessary pond area depends on the relation between the number of degrees of cooling required, and the net heat loss from each square foot of pond surface. Four principal mechanisms are involved in the change of water temperature. Heat is lost through evaporation, convection and radiation, and gained through solar radiation. If we are able to determine the net heat loss H, then the pond area can be found from the equation

$$A = -500 \int_{T_1}^{T_2} \frac{dT_w}{H} \qquad (1)$$

which is derived from the two relationships: $dT_w/dt = -H/62.4\ b$, for a column of water of depth b, and t

(hr) = 7.48 (gal./cu. ft.) × b (ft.) × A (sq. ft./gpm.) ÷ 60 (min./hr.).

Evaporation—Two of the more readily usable empirical equations for evaporation from a water surface are those of Rohwer and of Meyer. Expressed in the same units these are: Rohwer (Tech. Bull. 271, USDA, see Kent's Handbook, 11th Ed., Vol. II, p. 3-48)

$$I = 9.3\,(1 + X/3.7)\,(V_w - V_a) \text{ at sea level} \qquad (2)$$

and Meyer ("Evaporation from Lakes and Reservoirs," Minn. Resources Comm., June 1942)

$$I = 10\,(1 + W/10)\,(V_w - V_a) \qquad (3)$$

In the Meyer formula V_w is based on water temperature about 1 ft. below the surface and V_a is the average of morning and evening actual vapor pressures throughout the month. The two equations are not in serious disagreement, since available data indicate that wind speed above a pond surface is only one-half of two-thirds as great as the speed above the surrounding trees.

There are some other correlations based mostly on laboratory work which give higher evaporation rates and greater wind effects (e.g., S. J. Friedman on "Heat Losses from Tanks, Vats and Kettles," in *Heating & Ventilating*'s Reference Section, Apr. 1948).

The Meyer formula Eq. (3) is used here since it is based on extensive investigation of lake and reservoir evaporation. Since it was developed for natural water temperatures its validity at high temperatures may well be questioned. However, it yields more conservative results even at high temperatures than either the Rohwer formula or the laboratory work and therefore appears to be on the safe side.

Warming and saturation of the air as it moves over the water is said to be relatively unimportant, at least until the air has moved over several miles of water.

Convection—Various references agree that the convection coefficient for a flat surface facing up in still air is about 0.5 Btu./(hr., sq. ft., deg. F.) for a temperature difference of a few degrees, increasing to about 1.0 for a difference of 50 to 100 deg. F. We shall use a value of 0.8 in the present study.

The effect of wind velocity is somewhat more questionable. Reported values of the increase in coefficient for each mph. of wind velocity range from 0.16 to 0.32. (See, e.g., Marks' Handbook, 5th Ed. p. 378; Kent's Handbook, 11th Ed. Vol. II, p. 3-29; HVAC Guide, 1945, p. 84; *Heat. & Vent.* Ref. Sect., Apr. 1948, p. 96; *Phys. Rev.*, 1926, p. 779-87.) An average value of 0.24 is used here, based on wind velocity at or near the water surface, Hence:

NOMENCLATURE

- A Pond area, sq. ft. per gpm.
- b Pond depth, ft.
- D Approach to equilibrium $= T_w - E$. Subscripts 1 and 2 indicate initial and final values.
- E Equilibrium temp., deg. F. = water temp. at which H is zero, see Fig. 1.
- F $166 \log_{10} D - 0.62D + 0.0007D^2$
- G $166 \log(-D) + 0.62(-D) + 0.0007(-D)^2$
- H Net heat loss, Btu./(hr., sq. ft.) $= H_e + H_c + H_r - H_s$
- H_e Heat lost by evaporation, Btu./(hr., sq. ft.).
- H_c Heat lost by convection, Btu./(hr., sq. ft.).
- H_r Heat lost by radiation, Btu./(hr., sq. ft.).
- H_s Solar heat gain, Btu./(hr., sq. ft.).
- I Evaporation per month, in.
- M Factor from Fig. 5 $= G_1 - G_2$
- N Factor from Fig. 4 $= (D_1 - D_2)\,(72 - 0.62D_2 + 0.0015\,D_2^2)/D_2$
- P Factor from Fig. 3 $= F_1 - F_2$
- Q Factor from Fig. 2 $= 75/(W + 11)\,(10^{0.008s})$
- R Relative humidity of air, percent.
- t Time in pond, hr.
- T_a Air temperature, deg. F.
- T_w Water temperature at surface, deg. F.
- T_1 Initial value of T_w.
- T_2 Final value of T_w.
- V_a Partial pressure of water in air, in. Hg; $= RV_t$.
- V_e Vapor pressure of water at temp. E, in. Hg.
- V_t Vapor pressure of water at air temp. T_a, in. Hg.
- V_w Vapor pressure of water at temp. T_w, in. Hg.
- W Wind velocity (above trees) as reported by Weather Bureau, mph.
- X Actual wind velocity at water surface, mph.

$$H_e = (0.8 + 0.24\,X)\,(T_w - T_a) \qquad (4)$$

If the water is cooler than the air, then the heat gain by the water is less than this formula indicates. However, the water is usually warmer, so this complication is neglected. Even with water warming the final result will not be affected significantly.

Since the wind speed above the water is taken as half that above the trees, then:

$$H_e = (0.8 + 0.12\,W)\,(T_w - T_a) \qquad (4a)$$

Radiation from Water—According to the Stefan-Boltzmann law the radiation from the water would be $H_r = 0.173 \times 10^{-8}(T_w + 460)^4$ Btu./(hr., sq. ft.) for an emissivity of 1.0. However, the water receives radiation from the atmosphere and surrounding terrain, an effect which is variable and uncertain. Making the conservative assumption that the water is surrounded with objects at air temperature, the net radiation loss is approximately:

$$H_r = 1.0\,(T_w - T_a) \text{ for ordinary temperatures} \qquad (5)$$

Solar Radiation—Solar radiation is an important and highly variable factor in the performance of cooling ponds.

Maximum Expected Solar Radiation* in Btu. per Hour and Square Foot at Various North Latitudes.

	24-Hr. Avg. at North Latitude				Noon Value at North Latitude			
	30°	35°	40°	45°	30°	35°	40°	45°
January 1	65	50	40	30	240	205	170	135
February 1	75	65	55	45	270	240	210	175
March 1	90	80	75	65	305	285	255	220
April 1	110	105	95	90	340	320	300	280
May 1	120	120	120	115	360	350	335	320
June 1	130	130	130	130	365	360	345	335
July 1	130	130	130	130	365	360	350	340
August 1	125	125	125	120	360	350	340	325
September 1	115	110	105	100	350	335	315	300
October 1	100	90	80	75	315	295	270	245
November 1	80	70	60	50	270	245	215	185
December 1	65	55	45	35	240	210	175	140

* The solar radiation must be multiplied by the absorption coefficient for the pond, which appears to exceed 95 percent.

The values given in the table for direct plus scattered radiation on a horizontal surface, in Btu./(hr., sq. ft.), are based on analysis of Weather Bureau records for a number of stations throughout the country. These are clear-day values which are rarely exceeded even in the high arid regions. In most sections of the country the maximum values are 5-10 percent lower. The normal or actual average monthly values are only 50-60 percent of the tabulated values for most of eastern United States, and 80-90 percent in the arid southwest. For accurate figures local weather records should be consulted.

Combined Heat Loss—Total heat loss H from the water of the pond has already been seen to consist of $H_r + H_c + H_r - H_s$. Furthermore, we have obtained expressions for the first three of these terms. The fourth can be determined as the sum of the first three when the equilibrium temperature E is used and the net heat loss is therefore zero. Modifying Meyer's equation (3) from the inches-per-month basis to a basis of heat transferred by evaporation we obtain:

$$H_e = 75\,(1 + 0.1\,W)\,(V_w - V_a)$$

Adding this to Eqs. (4a) and (5) we get:

$$H = 75\,(1 - 0.1\,W)\,(V_w - V_a) + (1.8 + 0.12\,W)\,(T_w - T_a) - H_s \quad (6)$$

Then when $T_w = E$,

$$H_s = 75\,(1 + 0.1\,W)\,(V_s - V_a) + (1.8 + 0.12\,W)\,(E - T_a) \quad (7)$$

Substituting into Eq. (6) we get:

$$H = 75\,(1 + 0.1\,W)\,(V_w - V_a) + (1.8 + 0.12\,W)\,(T_w - E) \quad (8)$$

After adjusting for wind velocity at the water surface this equation is almost identical with that of Throne (*vide supra*) except that it is based on the Meyer formula whereas Throne used the Rohwer formula. The difference is not a major one. Throne indicated that in two small lakes he investigated the water temperature was almost uniform except for slight stratification, but he based his analysis on the entire lake surface being 2 deg F. above the outlet temperature. Temperature distribution is undoubtedly affected by pond shape and inlet-outlet temperature difference. In the test pond the present author found a well defined temperature gradient in the direction of flow.

The last expression could be combined with Eq. (1) and solved but it is convenient to have a suitable integrable expression for $1/H$ in terms of T_w. Empirical methods show that:

$$\frac{1}{H} = \frac{75}{10^{0.03E}\,(W + 11)}\left(\frac{0.144}{D} - \frac{0.123}{100} + \frac{0.029\,D}{10{,}000}\right) \quad (9)$$

within 5 percent for W = 0 to 20 mph., E = 60 to 140 deg. F., D = 0 to 100 deg. F., and T_w = 60 to 200 deg. F. Using 70 instead of 75 in the numerator will yield results within 10 percent for values of E and T_w as low as 40 deg. F.

Substituting Eq. (9) into Eq. (1) and integrating gives:

$$A = \frac{75}{10^{0.03E}\,(W + 11)}\,(166 \log_{10} D - 0.62D + 0.0007D^2)$$

For $D > 0$ this can be written as

$$A = \frac{75}{10^{0.03E}\,(W + 11)}\,(F_1 - F_2) \quad (10)$$

and for $D < 0$ it can be written as

$$A = \frac{75}{10^{0.03E}\,(W + 11)}\,(G_1 - G_2) \quad (11)$$

The first term in these equations represents Q, given by Fig. 2. The second term in Eq. (10) is P, given by Fig. 3, and the second term in Eq. (11) is M, given by Fig. 5. The nomograph of Fig. 1, for the E values used in these equations, is based on a rearrangement of Eq. (7) as:

$$(1.8 + 0.12W)E + 75\,(1 + 0.1W)V_s^* = (1.8 + 0.12W)T_a + 75\,(1 + 0.1W)RV_a + H_s \quad (7a)$$

Experienced nomographers may note that the solution here is theoretically inexact but the maximum error in E is about ±2 deg. F. for R < 50 percent, and ±1 deg. F. for R > 50 percent. The greater accuracy possible with a more complex chart is hardly justified.

It will be noted that these equations require the specification of air and water temperatures, relative humidity, wind velocity and solar radiation. The conditions required for Eq. (1) are not fully realized in an actual pond because of channeling, vertical stratification, eddy currents, pond depth variations and other factors. Channeling and stagnant areas are detrimental but stratification is beneficial since the cooling rate is increased by having warmer water at the surface. A limited amount of summer experimental work at the previously mentioned pond has shown that these factors are largely self-compensating so that the equations yield reasonably accurate results. However, known stagnant areas must be regarded as ineffective for cooling.

We have here used conservative values for heat loss by evaporation and radiation which might be expected to give high values for E. Observed data for comparison are not readily available. In natural lakes and ponds the effect of stratification is questionable. In rivers, however, the temperature at any point is the effect of weather conditions for several days past, and several hundred miles up-stream. Furthermore, solar radiation data are published for only a few weather stations, while estimates based on reported sky cover may produce errors up to several degrees in E. However, tests of Fig. 1 at one location, using monthly average weather conditions, have yielded E values generally only 2-3 deg. F. higher than actual river temperatures.

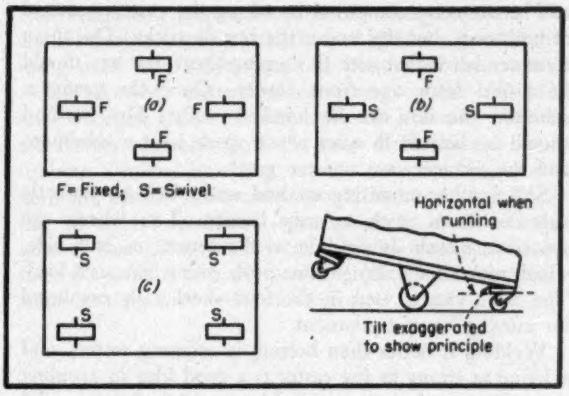
We have noted the need for uniform flow and lack of stagnant areas in a cooling pond. Except for small values of $(T_1 - T_2)$, we have also noted the bad effect of turbulence. As an extreme case assume complete mixing so that the entire pond is at temperature T_2. Then heat in = (gal./min.) × (lb./gal.) × (min./hr.) × $(T_1 - T_2)$/(sq. ft.) or $500(D_1 - D_2)/A$ Btu./(sq. ft., hr.). Heat out is given by Eq. (8). Letting $T_w = T_2$, using the values of $1/H$ from Eq. (9), equating heat in and out, and rearranging:

$$A = \frac{75}{10^{0.03E}\,(W + 11)} \times \frac{D_1 - D_2}{D_2} \times (72 - 0.62\,D_2 + 0.0015\,D_2^2) \quad (12)$$

The right hand part of the expression above is N in Fig. 4 and for turbulent conditions $A = Q \times N$, where Q comes from Fig. 2.

The Plant Notebook

Edited by Theodore R. Olive



What You Should Know About Casters For Materials Handling

ROBERT L. MILLER, *Chemical Engineer, Northern Ohio Engineering Co., Barberton, Ohio.*

★ **May Contest Prize Winner**

The number of casters in use in this country today doubtless exceeds the national debt, ranging all the way from the big ones on industrial trucks, to the small ones on furniture in your home. Surprisingly enough, although the manufacturers publish plenty on construction in their catalogs, little or nothing seems to have been published on application, either inside or outside the catalogs. And application, in the main, is miserable!

Following several years experience with perhaps a thousand wheeled units having casters, the author ventures to present a few of his findings—though without any claim to originality.

The tires of casters are made of steel, of plastic and of rubber. Of course, the character of the floors to be traversed has some influence, but I generally recommend steel, which is standard and less expensive, and rolls the easiest of any. They are harder on floors and will grind out both concrete and wood if the traffic is steady. But it is becoming more and more common to put the resilient material on the floor—and use a hard wheel, rather than the other way around.

The plastic wheel is more satisfactory than steel, takes a good load, and resists more conditions. It rolls almost as easily as steel and is easier on floors. But it is more expensive and if it is to be used only occasionally, the extra cost is not warranted. Rubber casters, however, are generally unsatisfactory since they get flat spots when standing loaded for long periods and push much harder under most conditions. They are the easiest on floors and are also advantageous on very hard, clean floors, such as are seldom found in industrial plants. A light rubber covering on a large steel wheel has the advantage that it will not pick up hygroscopic chemicals as does steel.

EFFECT OF SIZE

The size of a caster wheel is most important, the larger wheel rolling easier even over bumpy ground. Wheels of 4-in. diam. are generally accepted as standard for half-ton loads but anything over this should go to 6-in. and occasionally to 8. Floors dirty with chemical dust, or the usual rough floors, call for 6 or 8 in. Larger wheels also are easier on the floor and work better on mastic.

Tied in with wheel size, and usually a function of it, is the eccentricity of the swivel. While a larger eccentricity makes it easier to turn, it means that with tightly stored boxes, more room is needed to let the swivel rotate. Also, if swivel casters are at the box corners, a larger swivel puts the support farther under the box or truck, tending to make it top-heavy.

Regarding bearings and lubrication: Roller bearings generally speaking are best for heavy loads. Ball bearings don't seem to have the ruggedness needed for general plant use, while plain and self-lubricated bearings seem to pick up films that inhibit free operation. Lubrication—recommended as a monthly feature—helps to keep out foreign materials and adds to life. And yet I have seen trucks that haven't been lubricated in 10 years which still roll as if they had been greased yesterday!

Mounting is the most important factor. We use three systems for general use. The first and most popular (sketch a above) makes use of four fixed casters, two under the center of the sides of the box and one under the center of each end. The load balances on the center casters while turning. Then the force of pushing tilts the box forward slightly, engaging the forward caster so that

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★ **June Contest Prize Winner**

"How to Build a Leak-proof All-Plastic Valve for Maximum Corrosion Resistance."

A prize of $50 in cash will be awarded to Oliver M. Hahn, Polychemicals Dept., E. I. du Pont de Nemours & Co., Wilmington, Del. Mr. Hahn's interesting idea will be described in the September Plant Notebook.

$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. Each month's winner will be announced the second following month and published the third following month.

$100 ANNUAL PRIZE—At the end of each year the monthly winners will be rejudged to determine the year's best Plant Notebook article, which will then be awarded an additional $100 prize.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Articles which are acceptable but are not winners will be published at regular space rates ($10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

three carry the load in a straight line. The rear caster is in the air until such time as you wish to reverse. The amount of this clearance is important—generally about 1½ in. on a box 4 ft. long. Slightly more clearance helps convert the inertia of tipping into forward motion and helps distribute the load evenly over three wheels—but this obviously could be carried too far.

USE OF SWIVELS

Our next system (sketch *b*) is similar except that swivel casters are put at the ends, instead of fixed casters. Here the mounting is the thing. The swivel brings the caster farther under the box and adds to the tilt. Still more important, the swivels should be set so that the race is horizontal in the *running* position when the truck is tilted. To set them horizontally when the truck is horizontal means that while running they tend to come to the inside of the race, and resist turning. This tends to make the load run in a straight line as if the caster were fixed. By regulating the tilt of the race with respect to the truck, any combination of effect between full swivel and fixed caster can be obtained.

In general these two mounting methods give the easiest handling, since turning about the center is a natural way which still permits straight-line handling and contributes a psychological factor in neater alignment of stored trucks.

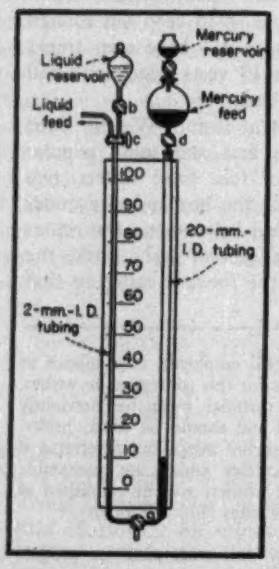
The third system is to use swivel casters on each corner of the box. This gives an advantage of maneuverability in close quarters, requiring no room to swing. The problem is moving in a straight line. The wandering tendency can be overcome somewhat by tilting the casters outward at both ends, but this makes the box do tricks. The thing to remember is that with this arrangement, the box should be pulled from one front corner. Once the swing is achieved the box can be handled easily. This method should be limited to cases where space is at a minimum and the distances are not too great.

Still another mounting method works well on perfectly balanced loads, such as soap frames. Two wheels are spaced as closely as possible to the center on each side, which makes for a straight-line push with a balanced load. The same idea is used in the four-wheel dolly employed for moving heavy equipment.

Welding is better than bolting in securing casters, and a frame as strong as the caster is a good idea in avoiding the tendency of casters to bend over when hitting solid objects. Even when a wooden box or truck is indicated, we build a frame of steel and mount the wood inside. Generally speaking we make the units as tall as practical to conserve space and allow pushing without bending over. It is a good idea to design the truck for the job—for example, so many to fit a freight truck, which then avoids the need to unload to pallets.

Mercury Piston Gives Close Control Of Liquid Feed Rates*

K. C. STEIN and F. J. SCHOENEWEIS, *Physical Chemists, Synthetic Fuels Research Branch, Fuels-Technology Div., Bureau of Mines, Region VIII, Bruceton, Pa.*



Frequently it is necessary to introduce small amounts of liquids into reaction systems at uniform rates. The simple glass apparatus described here has been useful in catalytic studies at atmospheric pressure. Essentially the apparatus is in the form of a glass U-tube manometer with mercury acting as a piston to displace the liquid.

For the apparatus shown in the sketch, a length of 2-mm.-I.D. tubing is connected through stopcock (a) to a length of 20-mm.-I.D. tubing. The liquid to be fed into the system is drawn into the 2-mm. tube by opening stopcock (*b*) to the liquid reservoir; (c) to the tubing: and (a) to the atmosphere. The level in the 2-mm. tubing then adjusted to zero reading. Stopcock (c) is then turned into the system. By adjusting stopcock (*d*) the flow of mercury can be regulated accurately enough to insure a constant liquid delivery rate. A further refinement in flow regulation can be obtained by placing a mercury-filled leveling bottle above the mercury feed reservoir. A constant level can be maintained in the feed bottle by regulating the flow from the storage bulb.

It is evident that any flow rate desired can be obtained by using various combinations of tubing diameters. In the apparatus described the areas of the tubing are in a ratio of 100 to 1. This means that a feed rate of 1 cc./hr. from the 2-mm. leg results from a displacement of 32 cm. This fact allows for fine control, so that any desired rate can be obtained.

*Contribution of Synthetic Fuels Research Branch, Fuels-Technology Div.; published by permission of the Director, U. S. Bureau of Mines.

Hints for Better Cuts in Large Glass Tubing

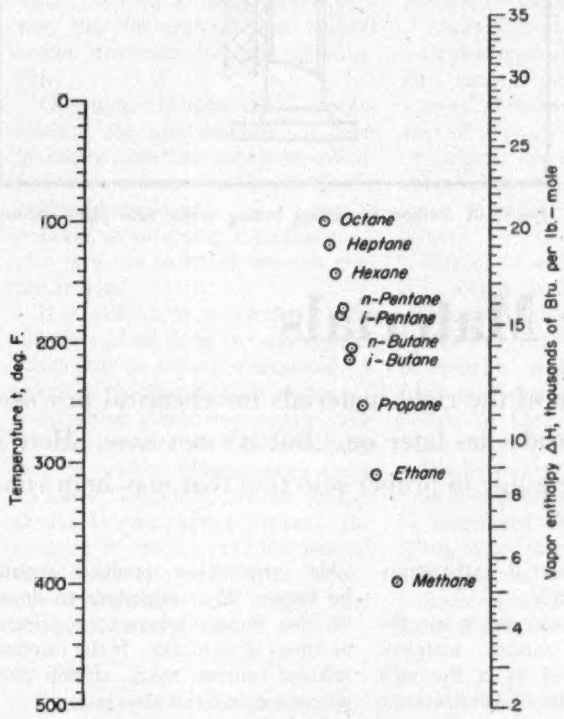
V. S. GUPTA, *Chemical Engineer, Shri Ram Institute for Industrial Research, Delhi, India.*

Here are some ideas which are well known to those who work in glass, but may be new to engineers and chemists who must make occasional cuts in larger diameter glass tubing for pilot plant and laboratory set-ups.

The use of a file mark for breaking tubing is satisfactory up to perhaps ¼ in. diameter, but above that size can't be counted on to give a smooth surface, or even to follow the etched line. So, for larger sizes, procure a piece of resistance wire long enough to allow connection across the 110-volt mains without burning out. The heating element from an old hot-plate will do nicely. Wind the

element around the tube with the ends as close together as possible without a short circuit, then allow it to heat red hot for 5-6 minutes. Now, with a pipette, allow a few drops of water to fall over the red-hot wire. The sudden contraction will cause a break exactly along the wire. For a still smoother surface hold the end against a grind-stone, using water and a little graphite powder as the coolant.

The alternate method of smoothing up the end of a large diameter glass tube with a flat file is usually not very satisfactory. Instead, hold the tube firmly in one hand, rubbing a folded wire gage rapidly over the broken end with the other. The motion should be at an angle of 60 deg. to the tube axis, and from outside to inside. This is quicker than filing and gives a smooth enough end for most purposes. For a still smoother job, finish on a grind-stone, cooling with water, as before.

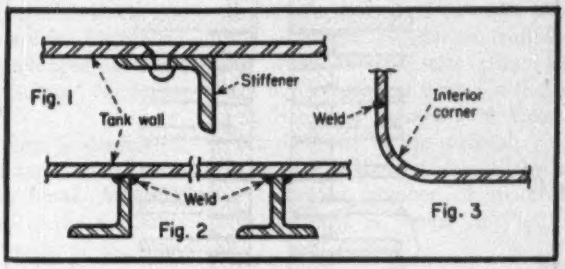


Nomograph Gives Enthalpies of Paraffin Hydrocarbon Gases

DALE S. DAVIS, *Professor of Chemical Engineering, Virginia Polytechnic Institute, Blacksburg, Va.*

Brown and his associates ("Unit Operations," Chap. IX, Wiley, 1950) present data for the enthalpies of paraffin hydrocarbon gases at constant low pressures. These are in the form of plots of vapor enthalpy (above liquid at 32 deg. F. and zero pressure), against temperature, for members of the hydrocarbon family between methane and octane, inclusive. A study of the data revealed that enthalpy ΔH and temperature t are related by the expression $\log (\Delta H + 10{,}000) = a + b\,t$, where a and b depend upon the hydrocarbon gas. This relationship is the basis for the accompanying line coordinate chart.

The use of the chart is illustrated as follows: What is the vapor enthalpy of propane at 230 deg. F? Connect 230 on the t-scale with the propane point and read the desired vapor enthalpy as 11,000 Btu. per lb.-mole on the ΔH-scale.



Build Better Design Into Your Rectangular Tanks

Ira A. Butcher, Consulting Engineer, Cincinnati 11, Ohio

Rectangular tanks are in common use throughout industry and where they are of any appreciable size they usually require either horizontal or vertical stiffeners, or both, if they are built of steel plate.

An examination of many of these tanks shows that it is common practice to build them with angles used for stiffeners, so applied as to be least effective for the materials used, as shown in Fig. 1. By reversing the angle and turning the leg outward, as in Fig. 2, the stiffener will be much more effective or a smaller stiffener can be used. Of course, a tee section would be still better than an angle.

A shop which started riveting its structural work years ago, and is still not interested in welding, could be expected to follow the old way but why do so now? Many tanks must have a smooth inner surface, free from rivet heads, laps, etc., so they may be effectively lined with rubber, lead or plastic liners. For such tanks welding offers many advantages.

Cleaning of tanks can be greatly facilitated by building them with smooth, rounded interior corners and this is where a little thought by the designer can be made to pay off both in construction costs and in operation. A rounded interior corner as shown in Fig. 3 can be made as shown with the end of the sheet bent, or by using two welds to join in a quarter of a circle.

The designer of tanks along these lines can expect to find many of the "old timers" against it, but if he will shop around he will find a fabricator open to new ideas and willing to go along.

Tag Lines and Valves Permanently

C. K. COOPER, *Area Supervisor, E. I. du Pont de Nemours & Co., Newport, Del.*

In the areas where the conditions are highly corrosive we had considerable difficulty in keeping lines, valves and switches identified. We tried out tags made from scrap Teflon sheet, stamping them with regular metal stamping dies. After a considerable period of service, this seems to be the solution to the problem.

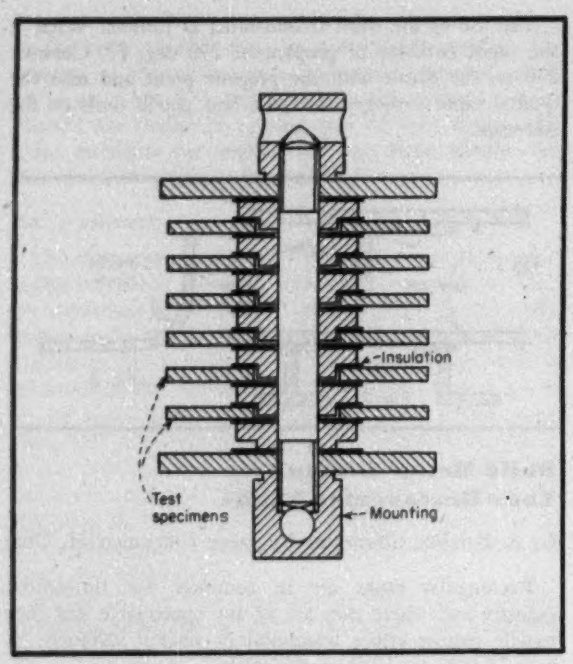


Fig. 1—Device for testing a number of materials simultaneously.

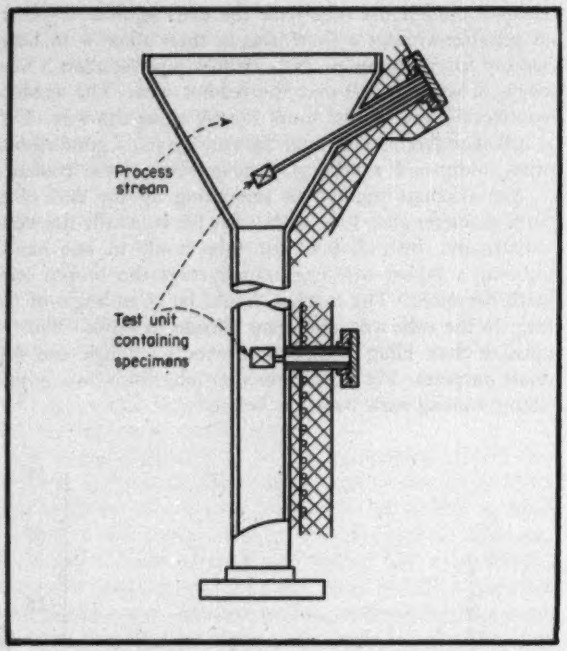


Fig. 2—A method for fitting testing device into plant stream.

How to Select Your Materials

Selection of the right materials for chemical processing equipment can save headaches later on. But it's not easy. Here's a comprehensive guide to proper selection that may help you.

H. W. VAN DER HOEVEN

One of the problems facing the corrosion engineer in the chemical industry is the choice of materials for new plants.

This choice is often restricted by price and availability.

It may be more economical to use cheap, moderately corrosion-resistant materials and regularly replace parts than to employ very expensive alloys. On the other hand, application of a thin lining of comparatively costly material to a steel structure may be economically more attractive than building a whole unit or plant of moderately expensive material.

Another factor governing the choice of material is the question of whether possible corrosion products will interfere with the process or contaminate the product to make it unsalable or less valuable.

Therefore, an investigation into the applicability of various materials should be preceded by a thorough study of the whole manufacturing process and of the constructional possibilities (including weldability) of the materials concerned.

In this article we deal with those process conditions which can be important in the choice of the material to be used, and with the constructional aspects of the choice of materials. Finally, in the light of examples, we explain some of the points mentioned.

PROCESS CONDITIONS

It may be useful to list the many factors affecting the corrosion investigation.

First, the exact compositions of feed stock, reaction mixtures and possible intermediate products should be known. It is important to know whether these substances are present as vapors or as liquids. If the reaction mixture contains solids, erosion phenomena may claim attention.

Next, the process temperature is important. Temperature often largely determines the rate of corrosive attack. It will determine if water drops will be present, which are possible sources of corrosion.

Pressures and rates of flow must be known, because these may affect the possible formation of protective layers of corrosion products. Dead space may cause locally different conditions and a modified corrosion picture, owing to the deposition of materials from the process stream.

Even small quantities of impurities—whatever their origin may be—may considerably affect corrosion resistance. Contaminations formed in

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one part of the plant, and comparatively harmless in that section, may give rise to serious trouble in other parts. Thus for example, traces of a corrosion product from a section made of copper-containing alloys may find their way into a section made of aluminum and there cause corrosion.

Composition of the gases present above the reaction liquid may also be important. Take, for instance, the influence of atmospheric oxygen on the corrosion of iron and copper-containing alloys in an acid medium. Sometimes the reaction liquid or the recycling liquid is oxidized by small quantities of atmospheric oxygen and undergoes such a change in composition that its aggressiveness towards certain materials increases considerably.

Operating temperatures, concentrations, etc. may fluctuate. It must be known how these variations will affect the corrosion resistance of the materials employed.

Leaks, as in heating or cooling coils, may give rise to attack through contamination.

It is difficult to assess the relative influence of all these factors, some of which may be entirely unexpected. A search of the literature for experience with similar plants may supply valuable information, but local conditions may be widely different from those described. Therefore, a close contact should be maintained between the designers of the plant and the material expert. Accurate and critical laboratory investigations may supply valuable supplementary data.

MATERIAL

Another aspect of the choice of material lies in the mechanical and physical properties of the material itself. Factors as machinability, weldability and ease of construction may influence the choice between the wrought and cast forms. As corrosion resistance may be partly determined by the quality of the material and variations in metal structure in and around welds, these points have to be considered carefully.

If during the erection of a plant stresses have been raised in the material owing to hot or cold working, a stress-relieving heat treatment may be required. Stresses may increase the susceptibility to corrosion (stress corrosion). A heat treatment may also be required to homogenize the material and thus improve its corrosion resistance.

Prolonged exposure to high temperatures during service may produce structural changes, such as sigma formation in stainless steels, which may make them very brittle. Graphitization of steel after prolonged use under certain high-temperature conditions may occur.

If the use of linings is considered, the best method of applying and welding them has to be found. Attention should also be paid to the possibility of depositing an overlay of corrosion-resisting material at the places where the rate of attack is highest.

Another point that should be considered is pretreatment of a metal surface, such as pickling, either for the removal of mill-scale or for the formation of a protective film. Machining of surfaces may improve corrosion resistance, e.g. the planing of welded joints to reduce the risk of depositions.

Plastics should be considered. As with metals, workability is important.

Thought should be given to the question of what paint systems should be used to protect the installation from the vapors escaping during the process or from liquids leaking outwards.

Finally, when erecting tanks and constructing pipelines, it will have to be determined whether the corrosivity of the soil or the presence of potential differences due to other causes call for cathodic protection, possibly supplemented with corrosion-resistant coatings.

EXPERIMENTAL PROCEDURES

In making corrosion experiments, different points of view can be adopted.

First, laboratory experiments may be based on a number of standard tests and from these a conclusion as to the suitability of the material can be drawn.

Secondly, the corrosion experiments may be adapted as much as possible to the conditions that will prevail in the plant or unit to be built. In view of what has been said in the introduction, it will be clear that this is the more usual procedure. This procedure may require the use of special, sometimes improvised, apparatus. On the other hand, it has the advantage of creating experimental conditions approximating as closely as possible those prevailing in actual practice.

Best method of handling corrosion problems in connection with the building of new plants is to start with laboratory experiments, then make trials in a semi-scale installation, and finally, when the full-scale plant has been built, place test strips (in the recycle lines, for example) to have a check on attack of the material.

One of the devices designed by us for testing a number of materials simultaneously is shown in Figs. 1 and 2.

Fig. 1 shows a "Copla" unit. This is an apparatus in which the materials to be tested are fitted in the form of round plates, insulated from each other.

Fig. 2 is an example of the method of fitting a "Copla" in a plant.

EXAMPLES

Some of the problems mentioned above will be explained in the light of examples.

In connection with the building of a chemical plant the corrosivity of a liquid mixture consisting of a very dilute hydrochloric acid (0.5 to 0.005 percent) and chlorinated hydrocarbons, possibly contaminated with ferric chloride, had to be examined at temperatures between 40 and 110 deg. C. In this mixture either water or chlorinated hydrocarbons could be the main component.

First, test strips of different materials were exposed at about 70 deg. C. to a medium consisting of an aqueous phase, containing 0.5 percent HCl and about 0.1 percent Fe^{+++}, and almost the same quantity of chlorinated hydrocarbons. Results of this experiment, carried out under stagnant conditions, are given in Table I. In the chlorinated hydrocarbon phase, there was practically no attack.

In the next series of experiments the air above the liquid was replaced by technical grade nitrogen, containing about 1 percent of oxygen. These experiments, carried out under flowing conditions at 40 deg. C. and an iron content of 0.01 percent in a medium otherwise comparable with that of the previous experiments, gave almost the same serious attack for Monel, but a fairly low general attack for silver and a silver-cadmium alloy (Table II).

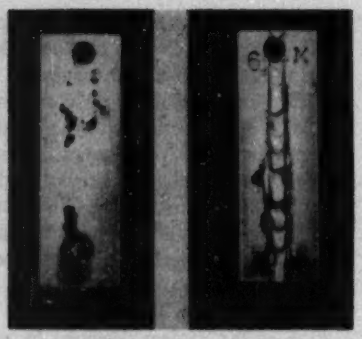


Fig. 3—Monel in dilute HCl

Fig. 4—Monel in semi-scale exposure.

From Tables I and II it can be seen that Hastelloy C and tantalum offer possibilities but the use of silver (as lining material, for example) is only attractive under certain conditions (i.e. at a low temperature and a very low iron content).

For this reason, and because the workability of Hastelloy C and tantalum in the case considered involved many difficulties, some synthetics (including a product based on phenol formaldehyde with asbestos fibers as filler, and a polyamide) were also tested. Under the influence of the iron compounds the phenol formaldehyde condensate began to separate dark decomposition products and the test strips showed cracks, while the product based on polyamide gave good results. Ultimately, for constructional reasons, neither of these materials was used, however, and project was so altered that contamination by iron was prevented.

The investigation was continued with Monel and silver in a medium containing no iron, consisting only of an aqueous phase with 0.01-0.004 percent HCl and chlorinated hydrocarbons. The experiments were made partly in Carius tubes, partly in a glass-lined, stainless-steel autoclave, with either air or nitrogen above the liquids. In the presence of air, attack took place in the water phase, at the rates stated in Table III.

Table I—Corrosion in Stagnant Liquid

Corrosion in the aqueous phase of a stagnant liquid, consisting of equal parts of chlorinated hydrocarbon and water. Aqueous phase contained 0.5 percent HCl and 0.1 percent Fe^{+++}; temp. 70 deg. C.; exposure time 10 days.

Material	Attack, Mm./Yr.	Type of Corrosion
Monel	2.5	Pitting
Silver	0.4	General
Hastelloy B	0.2	Pitting
Hastelloy C	0.07	General
Tantalum	<0.01	General

Table II—Corrosion in Moving Liquid

Corrosion in a moving liquid, consisting of equal parts of chlorinated hydrocarbon and water, the aqueous phase containing 0.5 percent HCl and 0.01 percent Fe^{+++}. Temperature 40 deg. C.; atmosphere 1 percent O_2, 99 percent N_2; exposure time 10 days.

Material	Attack Mm./Yr.	Type of Corrosion
Monel	2.4	Pitting
Silver	0.10	General
Ag-Cd alloy	0.17	General

Table III—Corrosion in Iron-Free Medium

Corrosion of Monel in the aqueous phase (containing HCl) of a liquid, consisting of equal parts of water and chlorinated hydrocarbons. Atmosphere: air; exposure time 10 days (stagnant conditions).

Material	HCl, %	Temp., °C.	Attack, Mm./Yr.
Monel	0.01	60	0.26
Monel	0.004	60	0.19
Monel	0.01	70	0.33

Attack of Monel in the organic phase was negligibly small (<0.01 mm. per yr.). Silver strips, both welded and unwelded, were attacked very uniformly at a rate of only about 0.03 mm./yr. in the aqueous phase.

Although the attack in the aqueous phase was not severe, it was disturbing to find after removal of the film of corrosion product, that the Monel surface showed etching. Test strips exposed in the same medium under nitrogen, although attacked at a much lower rate (0.06-0.07 mm. per yr.), showed, at random spots, a slight discoloration towards red. Micro examination revealed that at these spots a film of copper had been deposited in the Monel surface; and although the average attack was low, local attack must have been considerably higher than 0.06 mm. per yr.

A corresponding experiment with a welded Monel strip at 110 deg. C. gave an average rate of attack of 0.15 mm. per yr., which, for the area actually attacked, means a local attack of 0.6-0.8 mm. per yr. It was found that copper deposits occurred chiefly along the uneven spots of the weld, although at other places, as where a number had been stamped in, attack was also rather high (Fig. 3).

On inspection of a test plate which had been exposed in a semi-scale installation under similar conditions, it was found that attack had taken place more or less preferentially along the welded seam—so that this seam was, as it were, lying on top of the rest of the metal. Rate of attack was about 0.9 mm. per yr. (Fig. 4).

Continued experiments showed that the preferential attack along the welded seams was not caused by a difference in structure or composition between weld metal and base metal, but by the uneven surface.

Similar results were obtained with test plates exposed to the vapor phase of the water-containing chlorinated hydrocarbon. In these experiments the deposits on the plates consisted in some cases of small copper globules, which suggested that they had formed in water droplets present during the test.

Since the distinctly local attack of most of the test plates pointed to a surface effect, exposure tests were carried out in a nitrogen atmosphere with Monel test strips pretreated by various methods (polished, treated with fine and coarse abrasive paper, and sand-blasted). See Table IV.

In another series of plates stresses were set up in the material by first stress-equalizing the plates and then stretching them 5, 10 and 15 percent and by cold working (hammering). Table V shows that the presence of uniform stresses does not increase the

Table IV—Effect of Surface Preparation

Temp.: 60 deg. C.; medium H_2O + 5 g. HCl/liter; exposure time 12 days; atmosphere: nitrogen (stagnant conditions).

Monel Pretreatment	Attack, Mm./Yr.
Polished	0.020
Abraded with fine sandpaper	0.020
Abraded with coarse sandpaper	0.046
Sand-blasted	0.86*

* Thick, non-adherent copper layer.

Table V—Effect of Stresses

Temp. 90 deg. C.; medium H_2O + 5 g. HCl/liter; exposure time 12 days; atmosphere: nitrogen (stagnant conditions).

Monel Pretreatment	Attack, Mm./Yr.
Stress-equalised, 2 hr. at 315° C.	0.025
Ditto and 5% stretched	0.025
Ditto and 10% stretched	0.029
Ditto and 15% stretched	0.021
Hammered	0.23*

* Very strong local coppering.

rate of attack, but that unequal stresses may give rise to serious corrosion (see Fig. 5 and 6).

Finally, some experiments were made in which the last traces of oxygen were removed from the liquid and from the nitrogen atmosphere above it by the addition of a small quantity of sulfite. Attack was thus reduced to 0.01-0.02 mm. per yr.

Fig. 5—Coppering and etching of Monel.

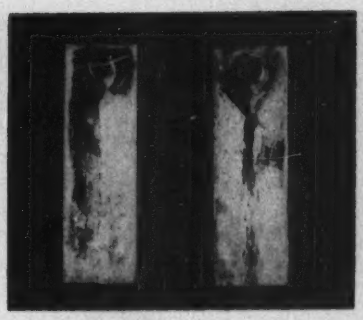


Fig. 6—Unequal stresses up attack.

EXPLANATION

In view of the results obtained, the following explanation of the corrosion mechanism in this medium may be put forward.

As in the case of nickel, the corrosion of Monel by strongly ionized acids such as hydrochloric acid is chiefly an electro-chemical process—electrons being exchanged between hydrogen ions and the metal. In the presence of oxygen the evolving hydrogen, which might polarize the cathodic places of the surface, is bound, so that the reaction proceeds.

The corrosion products are deposited at the anodic places, with formation of $CuCl_2$. The solution thus comes to contain copper ions and since the Monel surface is slightly less noble than copper, there will be a tendency to copper deposition (in any case at those places where, owing to insufficient flow, there is no continuous fresh supply of medium, so that there a larger proportion of corrosion products will be present). Moreover, copper will be deposited preferentially at places where, owing to unevenness of the surface, fouling occurs most easily. Once the copper has been deposited, an electrolytic cell will form between the deposited copper and the slightly less noble Monel, so that corrosion will locally proceed more strongly and pitting may occur.

Analysis of the test liquid after exposure confirmed that nearly all the copper that is initially dissolved is subsequently deposited on the Monel surface (at least in a stagnant medium). It contained about 35 mg. Ni per liter and 1-2 mg. copper per liter. Since the ratio between nickel and copper is about 2:1 in Monel and about 15:1 in the liquid, this points to a very strong tendency to copper deposition. Whereas stagnant conditions give rise to an accumulation of corrosion products, flowing conditions may cause a regular supply of the oxygen dissolved in the liquid.

Presence of a chlorinated hydrocarbon in an aqueous medium at high temperatures may complicate the corrosion process through hydrolysis. The attack of the Monel strips in the vapor phase, already referred to, may be attributed to the presence of water droplets which have condensed on the Monel. These water droplets, which are enveloped by a film of chlorinated hydrocarbon, absorb the hydrochloric acid produced by hydrolysis. Calculations have shown that under these conditions, even at a very low HCl content in the original liquid, these water drops may contain over 0.5 percent of HCl. Oxygen possibly present in the vapor phase may stimulate the corrosion due to this hydrolysis.

The investigation discussed in the foregoing clearly shows that, if Monel is used, the presence of oxidants (even of atmospheric oxygen dissolved in the liquid) should be avoided. It shows that even in the presence of comparatively small proportions of atmospheric oxygen the metal may, under certain conditions, be locally attacked at the rate of 1 mm. per yr.

Furthermore, the apparatus should have a minimum of dead space and therefore be so designed as to promote easy flow. In this case the surface treatment of the Monel is of great importance. Welded seams should be abraded until flush with the surrounding material. Local stresses should be relieved by two hours' heating at 315 deg. C. Local cold-working, e.g. hammering, is not permissible.

From the point of view of corrosion, use of silver, (as lining material in a steel structure for example), can be recommended. Some experiments have shown that it is attacked uniformly and at a very low rate. This material presents no difficulties concerning welds or surface condition. Under the conditions described silver will probably be attacked at the rate of 0.03 to 0.05 mm. per yr. Indeed, the silver lining installed in one of our plants behaves entirely as expected.

Practice trials with Monel have also confirmed the results of this investigation.

INFLUENCE OF CONTAMINATIONS

It is a well-known fact that the corrosion resistance of stainless steels of the 18/8 type in reducing media can be improved by the addition of a few percent molybdenum. It is generally assumed that this improvement is due to the acid character of the molybdenum oxide present in the passivating oxide film on the stainless steel. For reducing media, therefore, stainless steels containing 2-4 percent molybdenum are usually employed.

In an investigation into the corrosion resistance of such chrome-nickel steels containing molybdenum when exposed to aqueous sulfur dioxide solutions at elevated temperatures, special attention was paid to the possible influence of small quantities of sodium chloride that might occur in these solutions as an impurity.

Chlorides in general have an unfavorable effect on the corrosion resistance of 18/8 stainless steels because the chloride ion can locally penetrate through the oxide film, causing pitting and, eventually, perforation. Since in general little is known of the influence of the molybdenum content on resistance to solutions containing chloride at various temperatures, some experiments were made on this subject.

Test plates, some of them welded, were placed in Carius tubes containing an aqueous solution of 10 percent SO_2 and 0.5 percent NaCl, at temperatures varying between 90 and 140 deg. C. The results are given in Tables VI and VII.

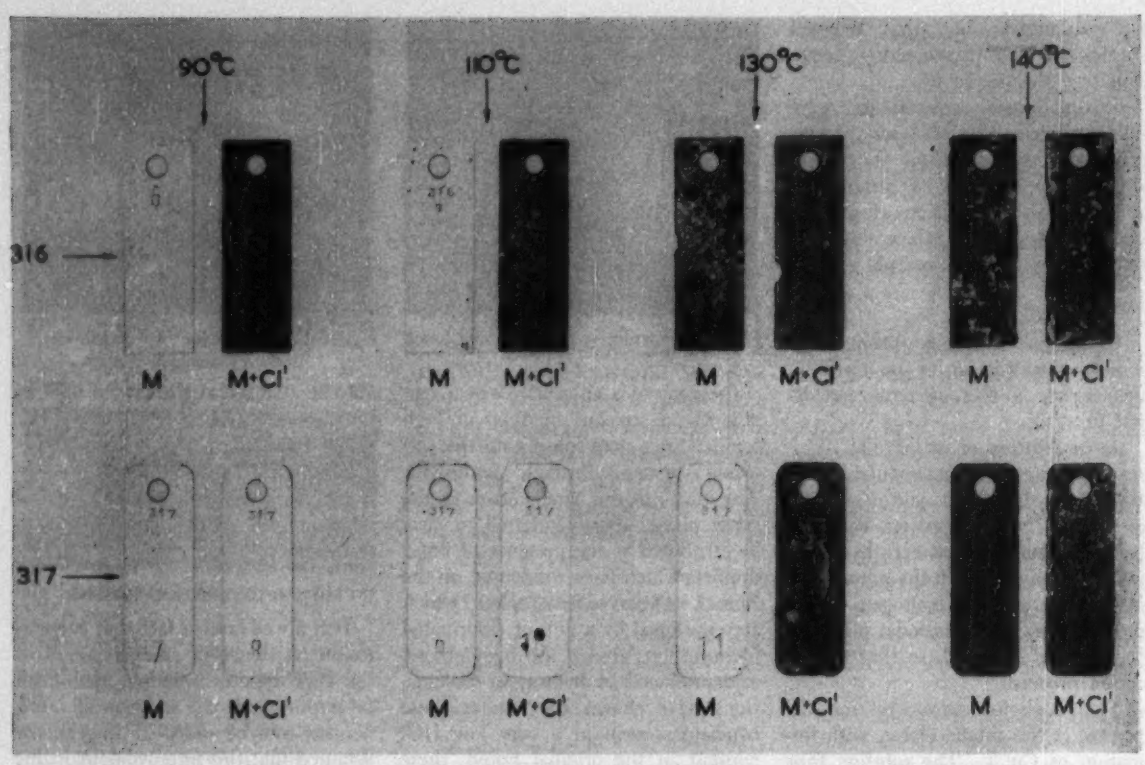


Fig. 7—Attack of Types 316 and 317 stainless steels by dilute SO_2 solution vs. temperature and effect of chloride ions.

Table VI shows that in a chloride-free reducing medium there is hardly any difference between stainless steels with increasing molybdenum content. Only AISI 316 shows a tendency to stronger attack (especially pitting attack) at high temperatures than steels with a higher molybdenum content.

Comparison of the attack of the steels containing 3-5 percent of molybdenum shows that no further improvement in corrosion resistance is effected if the Mo content exceeds 3 percent. On the contrary, the figures of corresponding experiments with 5.1 percent Mo steel are less favorable than for steel containing 3.1 percent Mo. Possibly the surface condition of these steels was not the same.

It also appears that if a rather strongly reducing medium is present, penetration of the oxide film of the stainless steel is a matter of time. As long as no penetration has taken place, attack is in general low. However, once the film has been penetrated attack may become very high (Fig. 7). This is clearly demonstrated by the corrosion figures of AISI 317 at 140 deg. C. after 3 and 7 days' exposure (6.2 and 279 g. per sq. m. per day, respectively).

That the presence of chlorides promotes attack is shown by the data in Table VII, from which it can be seen that AISI 316 fails at 90 deg. C. and the other materials at 110 deg. C., especially on prolonged exposure. A striking feature is the large difference between duplicate measurements with AISI 317 after a fortnight's exposure at 110 deg. C. One of the strips was practically unattacked, while the other showed serious pitting. Possibly this was due to early penetration of a locally weak or damaged oxide film by chlorine ions.

Exposure tests with welded specimens showed that in general welding reduces the resistance to a medium containing chloride. In this medium, too, corrosion resistance can hardly be said to increase with increasing molyb-

Table VI—Attack in SO_2 Solution

Attack (in g/sq.m./day) of various stainless steels in a 10% SO_2 solution after x days' exposure.

Temp., °C.	16.9 Cr, 12.1 Ni, 2.4 Mo (AISI 316)				18.9 Cr, 12.0 Ni, 3.1 Mo, (AISI 317)				18 Cr, 12 Ni, 3.5 Mo, Tant. + Niob. 1%				16.5 Cr, 13.9 Ni, 5.1 Mo			
	3 d	7 d	14 d	21 d	3 d	7 d	14 d	21 d	3 d	7 d	14 d	21 d	3 d	7 d	14 d	21 d
90	0.53	0.23			1.2	1.5										
110		1.7[P] 1.4				0.4 0.7	0.8	1.0		1.1 1.2*	2.4*			0.9 1.8*		
120	3.6				1.4								3.1 4.4*			
130		160[P]				1.7							7.3			
140	443[P]	224[P]			6.2	279[P]							19.7			

P = pitting attack * welded specimen.

denum content, perhaps with the exception of AISI 316, which already showed serious pitting at 90 deg. C. Results of the experiments with the two media—with and without chlorine ions—may suggest that a molybdenum content of 3 percent in the steel is sufficient for the formation of a protective film, so that an increase in Mo content would be useless for this purpose.

That heat treatments may strongly influence the corrosion resistance of this material was illustrated by the following fact: Steel containing 5.1 percent Mo, after heating at 700 deg. C. and 3 days' exposure to a medium containing chloride at 120 deg. C., showed attack at the rate of 119 g. per sq. m. per day as well as serious pitting, whereas the non-heat-treated material showed an attack of only 3.1 g. per sq. m. per day. This strongly increased attack must be due to the formation of sigma phase in the test strip heated at 700 deg. C.

This investigation clearly demonstrates not only the adverse effect of chlorides, in this case present as "contamination," but also the great influence of exposure time on the corrosion picture. It must therefore be recommended not to work with too short exposure times.

INFLUENCE OF AGING

That the aging susceptibility of a medium may have an important bearing on the choice of materials was demonstrated by an investigation into the corrosivity of an aqueous diethanolamine solution saturated with hydrogen sulfide. The materials used in this investigation included aluminum-brass (76 Cu, 22 Zn, 2 Al), an alloy very attractive for use in condensers, especially those using seawater as the coolant. Low-carbon steel was the other material used in the investigation.

Owing to the presence of H_2S, the above-mentioned liquid can easily be oxidized by atmospheric oxygen. Therefore, the experiments were originally carried out under a nitrogen atmosphere while the corrosion resistance of aluminum-brass and steel with respect to the partially oxidized (aged) liquid was investigated.

Attack of aluminum-brass and low-carbon steel by a freshly prepared, non-oxidized solution is comparatively slight and, owing to the formation of a protective layer of corrosion products, attack decreases with the time. In Table VIII, the results of some exposure tests under nitrogen atmosphere have been listed.

Table VIII—Attack Under Nitrogen Atmosphere

Relation between exposure time and rate of attack of aluminum-brass and low-carbon steel in a non-oxidized diethanolamine solution in water, containing H_2S and CO_2. Temp. 105° C; nitrogen atmosphere; stagnant conditions.

Material	Exposure Time, Days	Attack, Mm./Yr.
Al-brass	7	0.49–0.59
Al-brass	14	0.28–0.30
Al-brass	21	0.18–0.22
Low-carbon steel	7	0.10
Low-carbon steel	14	0.06
Low-carbon steel	21	0.04

In these tests the solution contained about 20 liters of hydrogen sulfide per liter of solution and a small quantity of carbon dioxide.

Experiments on the corrosivity of a diethanolamine solution (DEA solution) containing hydrogen sulfide which had for a considerable time been stored in a bottle under air, showed that the attack of aluminum-brass increased as the liquid had had more opportunity to oxidize.

During storage the hydrogen sulfide content decreased, while the liquid became yellow and after some time showed precipitation of sulfur. The corrosion resistance was measured after different times of storage of the test liquid, so that information was obtained on its corrosivity immediately after preparation and after 49, 87 and 171 days' aging. The exposure tests were this time carried out not under nitrogen, but in Carius tubes under air at 100 deg. C. Again test specimens were exposed to the medium for different periods (see Table IX and Fig. 8).

Table IX—Attack by Aged Solution

Rate of attack of aluminum-brass by a partly oxidized (aged) diethanolamine solution in water, containing H_2S and CO_2, which solution was resaturated with H_2S before test. Temp. 100° C. atmosphere: air (stagnant conditions).

Aging Time, Days	Exposure Time, Days	Attack, Mm./Yr.
0	7	0.67–0.82
0	14	0.40
49	7	1.23
49	14	0.51–0.83
49	21	0.34
87	7	(1.2–2.4) (pitting)
87	14	(1.0–1.3) (pitting)
171	10	3.4–3.7

These results show that the attack increases with the time of aging and that again a more or less protective layer is formed, so that the rate of corrosion decreases with time. However, in some cases there is also the pitting type of attack, which is usually accompanied by a wide spread in corrosion figures.

The foregoing clearly demonstrates that under these conditions aluminum-brass can no longer be considered as a suitable construction material. Fig. 8, in which the data from Table IX have been incorporated, shows that there is a logarithmic relationship between attack and time of aging.

If aging is effected artificially, by passing air through the H_2S-DEA so-

Table VII—Attack in SO_2 Solution Containing NaCl

Attack (in g./sq.m./day) of various stainless steels in 10% SO_2 solution containing 0.5% NaCl, after x days' exposure.

Temp., °C.	16.9 Cr, 12.1 Ni, 2.4 Mo (AISI 316)				18.9 Cr, 12.0 Ni, 3.1 Mo (AISI 317)				18 Cr, 12 Ni, 3.5 Mo Tant. + Niob. 1%				16.5 Cr, 13.9 Ni, 5.1 Mo			
	3 d	7 d	14 d	21 d	3 d	7 d	14 d	21 d	3 d	7 d	14 d	21 d	3 d	7 d	14 d	21 d
90	91P	128P			0.6	0.3										
110		108P 192P			0.8	8.1P 0.4	{79P 0.6	{95P 112P		1.2 *5.2P	*145P	*150P		0.9 *8.0P		
120	4.0 52P	218P			{0.8 1.5	277P							3.2 *21P	384P		
130		165P				158P				*			57P *30P			
140	380P	170P			116P	233P							228P			

P = pitting attack * welded specimen.

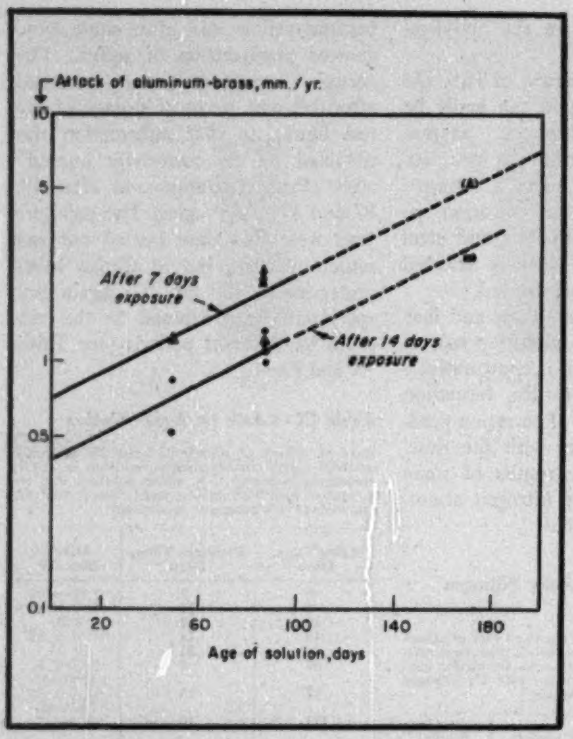


Fig. 8—Attack of aluminum-brass vs. aging time with aqueous diethanolamine solution saturated with hydrogen sulfide.

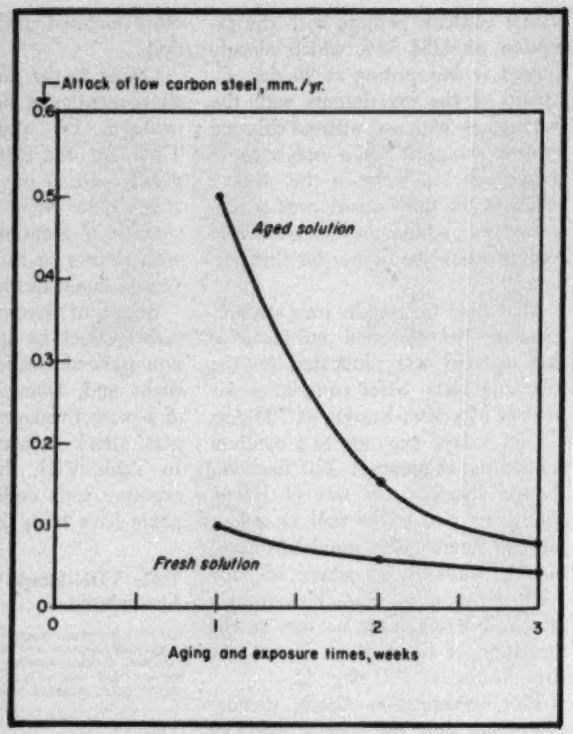


Fig. 9—Attack of low carbon steel by same solution under condition of simultaneous aging and exposure.

lution, much higher corrosion figures are obtained, both for low-carbon steel and for aluminum-brass.

However, since it is not to be expected that in actual practice the H_2S-DEA solution will be subject to such intensive oxidation as described above but will probably be in contact with a gas containing a small proportion of oxygen, some experiments were carried out with a H_2S-DEA solution which was aged by passing through a gas stream consisting of 99 percent nitrogen and 1 percent oxygen. Moreover, allowance was made for the fact that in practice aging will take place simultaneously with the attack of the materials present in the plant. Thus, the rate of attack was determined for steel and aluminum-brass after 1, 2 and 3 weeks' ageing and 1, 2 and 3 weeks' exposure. Results of these experiments are given in Table XI.

Table X—Attack by Artificially-Aged Solution

Influence of artificial aging (oxidation) of diethanolamine solutions, containing H_2S and CO_2, on rate of attack of aluminum-brass and low-carbon steel. Temp. 105° C.

Material	Exposure Time, Days	Attack, Mm./Yr.
Al-brass	10	0.42
Al-brass	10	(3.3–2.7) pitting
Low-carbon steel	7	0.10
Low-carbon steel	7	0.7–0.8

Table XI—Attack Under Simultaneous Aging and Exposure

Rate of corrosive attack that can be expected under practical conditions, when aging time and exposure time are going hand in hand (temperature 105° C.).

Material	Aging Time, Weeks	Exposure Time, Weeks	Attack, Mm./Yr.
Low-carbon steel	1	1	0.5
Low-carbon steel	2	2	0.15
Low-carbon steel	3	3	0.06
Al-brass	1	1	(1.2) initial pitting
Al-brass	2	2	(1.8) pitting
Al-brass	3	3	(1.4) heavy pitting

Table XI shows that under these conditions the use of low-carbon steel is possible, aluminum-brass again being unsuitable because of the type of attack. In Fig. 9 the data for low-carbon steel have been plotted.

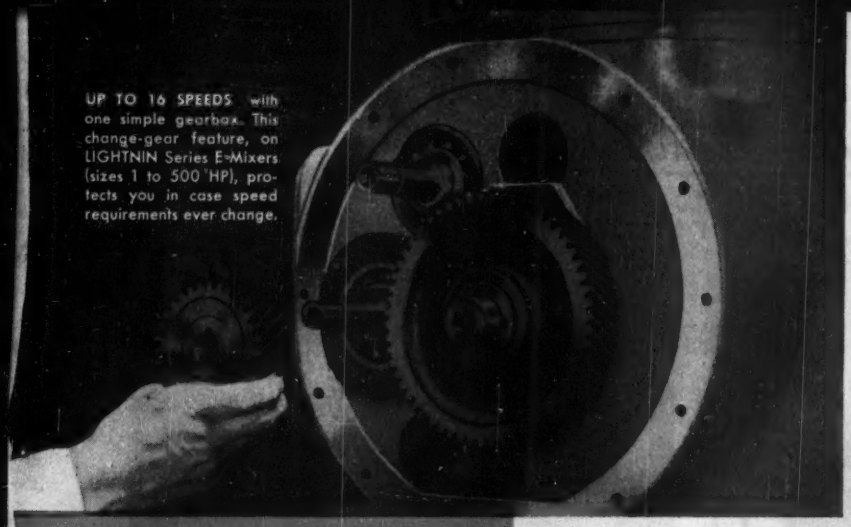
It can be seen that aging of the liquid actually increases attack. However, the corrosion curve falls rather rapidly, so that it may be expected that low-carbon steel actually meets the demands. These experiments were carried out under stagnant conditions; practical experiments will have to show whether flowing liquids will easily damage the protective layer of scale. If they do, steel may also show strong local attack.

From this investigation it can be concluded that if the aging susceptibility of the reaction liquid is among the factors governing corrosion, experiments should be so arranged so that aging time and exposure time are varied simultaneously, because only then can reliable information be obtained on the changes in attack on aging.

Although it is realized that in the present article only some aspects of corrosion research have been dealt with and many of the problems mentioned in the introduction have been left undiscussed, it is hoped that it may contribute to a better understanding of the problems relating to the choice of construction materials for chemical plants.

ACKNOWLEDGEMENT

The author is indebted to the management of the N.V. De Bataafsche Petroleum Maatschappij for permission to publish this article.



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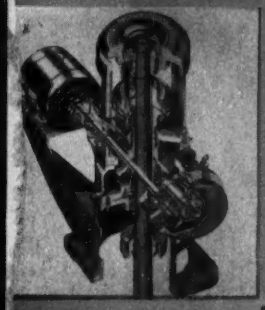

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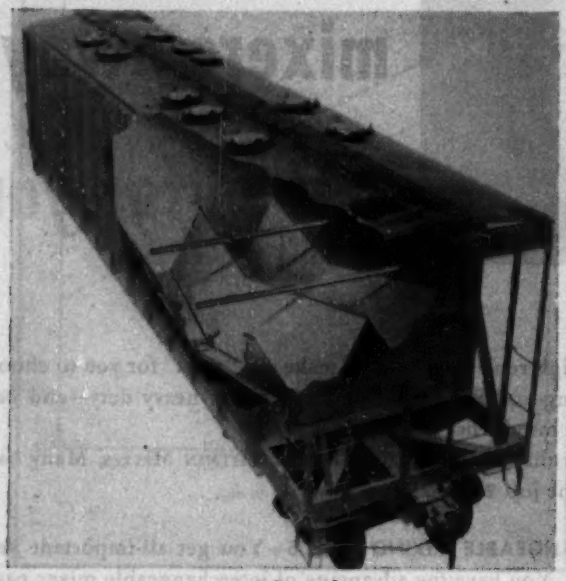
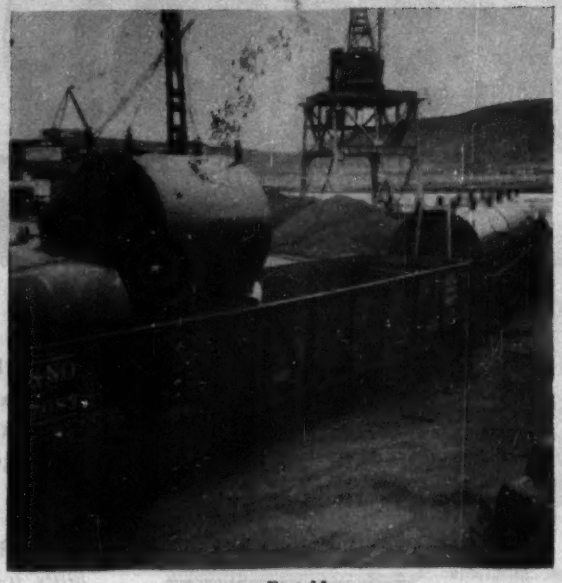


A Covered hopper.



B Portable tanks.

New Tricks for Bulk Shippers

Two techniques are scoring with bulk shippers. One —unloading dry solids from covered hopper cars by fluidization. The other—shipping fluids in portable tanks.

Along the entire front of materials handling and movement, men are striving mightily to cut costs from operations that annually gobble 25 or 30 percent of the process dollar. Initially the battle was joined on production lines and in the warehouse. The outcome of these skirmishes has been the adoption of continuous conveyor systems and unit loads with new equipment continually evolving.

Now the turmoil has percolated up into heavy tonnage bulk handling and movement. Here the trend is away from unit packages to large bulk containers; away from sacks, barrels and drums to cars and tanks designed to protect materials fully as well as the smaller individual containers. And handling techniques for these bulk containers are shaving labor costs and shortening turn-around time.

Dry solids of a powdered or granular nature are being shipped by covered hopper cars in ever increasing quantities. To help meet and increase this trend a new Airslide freight car has been announced recently. Substantial savings in labor, dunnage and containers are claimed for bulk handling jobs not previously considered practical. In addition the car is said to provide improved sanitation and less danger of contamination.

Loading of the Airslide car is done through watertight roof hatches. Hopper sections consist of two trenches running the full length of the car on both sides of the center sill.

Fastened to the underside of each trench is an Airslide consisting of sturdy silicone-treated fabric ¼ in. thick by 12 in. wide. The underside of the Airslide fabric is totally encased by a U-section of light gage steel. This U-section acts as a chamber to direct low pressure air through the fabric during unloading operations. Air passing through the fabric aerates or fluidizes the lading. This causes the commodity to flow by gravity down the 15 deg. slope of the Airslide to the discharge outlets.

Other features of the design help the Airslide complete its job with a bare minimum of solids hold-up after unloading. Wherever possible welded construction is used. Slope sheets make a 60 deg. angle with the horizontal to ensure minimum product retention. Where desired, a penetrating wax treatment can be applied to all interior surfaces. This gives a smooth, non-toxic, corrosive-resistant lining.

Cars are made in 3 sizes: 2,000, 2,600 and 3,600 cu. ft. capacities. Air for the slide should be supplied at 1 psi. and 200 cfm. Blowers for unloading can be purchased on the open market for $500 to $600.

On another front shippers of bulk fluids are turning to portable tanks midway in size between steel drums and tank cars. They offer an answer for shipments that can't be handled economically in steel drums yet are too small for tank cars or tankers. And they can be emptied and returned immediately or held in storage until the contents are needed.

Most tanks are handled on a lease

Equipment Cost Indexes

(Marshall & Stevens Indexes, 1926 = 100)

Industry	Mar. 1952	Dec. 1952	Mar. 1953
Average of all.....	180.2	180.8	180.7
Process Industries			
Cement mfg.	172.8	173.0	172.7
Chemical	180.8	181.4	181.1
Clay products	167.8	168.0	167.7
Glass mfg.	170.9	171.4	171.1
Paint mfg.	174.1	174.7	174.4
Paper mfg.	174.4	175.0	174.7
Petroleum ind.	177.2	178.1	177.8
Rubber ind.	179.6	180.5	180.2
Process ind. avg....	178.2	178.9	178.6
Related Industries			
Elec. power equip...	182.4	183.3	183.0
Mining, milling	181.5	182.4	182.1
Refrigerating	200.3	201.2	201.0
Steam power	170.0	171.0	170.7

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, **Chemical Engineering**, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see **Chemical Engineering**, March 1953, pp. 220, 221.

basis with the owner, Transit Tank Co., shunting them back and forth in the same way a railroad operates its freight cars. A regular tank service is also being inaugurated on a tariff basis.

Cost of a 3,000 or 4,000 gal. tank is $25 or $30 a month. A small tank can be leased for $5-$7 a month. Charges vary widely depending on the quantity of tanks leased, lease period, depreciation, wharfage, handling and transportation. Minimum order is one tank.—*Airslide car; General American Transportation Co., 135 South LaSalle St., Chicago 90, Ill. Portable tanks; Transit Tank Co., Richmond, Calif.*

Unloading Platform Swings Over Tank Cars

A

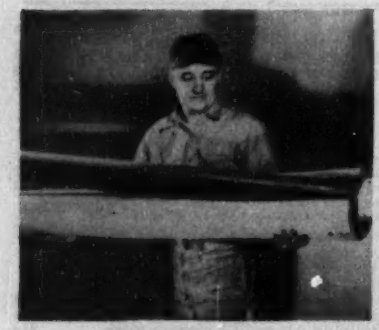
No longer is it necessary for a man to stand on the curved, slippery tops of railroad tank cars during loading and unloading operations. A new column-mounted platform swings over the tank car giving easy access to the dome. At no time is the operator required to leave the platform.

From the grated deck of the platform the operator can turn the platform 360 deg., stopping at any angle over the top of the tank car. Once the platform is in position the operator can hook up for the loading or unloading operation.

Platform is carefully balanced and rides on roller bearings. It is turned easily by the crank wheel on the platform which is geared to the supporting steel column. Before the platform can be turned the operator must depress a foot-brake lever which holds the platform stable in a stopped position. When not in use the platform can be locked in a safe position parallel to the tracks.—*Nichols Engineering Co., 3816 West Grand Ave., Chicago, Ill.*

IN BRIEF—A capsulated listing of this month's newsworthy equipment.

		Page
New Packaging & Handling Equipment		
Covered Hopper Cars	Have Airslide to fluidize solids for unloading	210
Portable Tanks	Simplify shipment of fluids in l.c.l. lots	210
Unloading Platform	Mounted at trackside, swings over tank car	211
New Materials of Construction		
Pipe Insulation	Is molded of resin-bonded glass fibers	212
Plastic Pipe	Now is marked at 10 ft. intervals throughout coil	212
Nylon Nozzles	Show good record against corrosion and abrasion	212
Noise Baffles	Made of glass fibers are hung from ceilings	212
Floor Grating	Of aluminum resists corrosion, is sparkproof	212
Lead-Clad Steel	Used in fabrication of large petrochemical tower	212
New Instruments & Controls		
Holiday Detector	Spots flaws in pipe and tank coatings	214
Vacuum Gage	Now modified to greatly increase range	214
Circuit Breaker Tester	Ensures that circuit protective devices work	214
Chart Drive	Speeds up for detailed record of trouble	214
Mass Flow Meter	Measures free-flowing dry solids rates	214
New Safety Equipment		
Fog Nozzle	For industrial use has low initial cost	216
Bulletin Board	Attracts attention to safety message by flashing	216
Foam Truck	Has metering system to proportion mixture	216
Portable Extinguisher	Has new squeeze-type valve, costs less	216
Burn Spray Kits	Contain aerosol dispensers for protective solutions	216
Sprinkler Head	Distributes higher proportion of fine droplets	216
Fog Nozzle	Gives better atomization at lower pressures	216
Goggle Wash Fountain	Has foot-operated valve freeing hands for cleaning	216
Safety Shut-Off Valve	Stops flow of process fluids in case of fire	216
New Heating & Cooling Equipment		
Heat Transfer Inserts	Step up heat transfer rates by channelling flow	218
Dehumidifiers	For low temperatures now offered in larger sizes	218
Graphite Cascade Cooler	Is redesigned for wider application	220
Air-Cooled Exchanger	Cools better at high temperatures and pressures	221
Burner Attachment	Instantaneously switches from one fuel to another	221
Packaged Boiler	Includes all accessories ready for installation	221
Steam Valve	Holds seal over wide temperature range	222
Industrial Heaters	Are improved to deliver large volume of hot air	222
New Electrical & Mechanical Equipment		
Thread Cleaner	Cleans pipe ends and threads in 6 to 8 sec	224
Oil Drum Stand	Permits recovery of liquid heel in drum	224
Low Voltage Switchgear	For 600 v. a.c. has air circuit breakers	224
Plastic Dipped Gloves	Can be reconditioned at fraction of original cost	224
Pipe Saw	Cuts with abrasive wheel, leaves square surface	224
Variable Speed Drive	For 1 hp. or less is flexible and low cost	225
Stationary Prime Mover	For heavy-duty jobs runs well on gas or oil	225
Speed Reducer	Slips onto electric motor shaft	226
Tube Cleaner	Is air-driven and uses carbide-tipped bits	226
Tube Expander	Eliminates step rolling into thick tube sheets	226
Work Tower	Telescopes up and down, has outrigger legs	227
Welding Electrode	Gives maximum in. of weld per electrode	227
Masonry Drill	Will not stall from dust packing	227
New Processing Equipment		
Metallic Filter Medium	Is smoother and stronger than previous grades	228
Grinding Mill	Is laboratory replica of production models	228
Pressure Vessel Door	Has split-ring closure for rapid opening	228
Dyeing Machine	Boosts processing speed, cuts dye consumption	228
Ball Mill	Can be modified in size and type of discharge	228
Chlorine Dispenser	Proportions and mixes gas with water	228
Automatic Sampler	Cuts sample from stream at pre-set intervals	228
Thickener Screen	Deflects wind to avoid settling disturbance	228
New Fluids Handling Equipment		
All-Metal Filter	Removes plus 2 micron dirt from petro products	230
Vacuum Pumps	Now truck mounted for emergency or test use	230
Tube Fittings	Eliminate need for flaring tools, dies, welds	230
Plastic Pipe	Handles corrosive chemicals at high pressure	230
Dust Tube Blow Rings	Are self-adjusting around individual tubes	232
Control Valve	Operates either automatically or manually	232
Centrifugal Pump	Constructed of plastic resists corrosion	234
Tube and Pipe Fittings	Have synthetic rubber seals, absorb vibration	234
Slurry Line Magnet	Mounted in line traps tramp iron particles	235
Self Priming Pump	Combines compactness, simplicity, high capacity	236
Filter Fabric	Is made of non-woven cotton or rayon fibers	236
Vapor Trap	Removes nuisance particles from exhaust vapors	238
Diaphragm Valve	Is pilot operated for control of corrosives	238
Close-Coupled Pump	Permits greater ease of installation	239
Slurry Pump	Handles abrasives over wide head range	239



Glass Pipe Insulation Is Molded in One Piece A

Just spread it open at the seam, place around pipe and allow to snap back to its cylindrical shape and you'll have another 6 ft. of pipe insulated. What's more the thermal conductivity of G-B Ultrafine pipe insulation is said to be considerably lower than that of any conventional pipe covering. And it is claimed to be 4 to 10 times lighter.

Furnished in 6 ft. sections the insulation is made of fine blown glass fibers bonded with a phenolic resin. It's cut easily with an ordinary knife; no special tools are required.

Possessing complete resistance to rot, mold, decay, and moisture absorption it will also resist the attack of most acids and alkalis. It is suitable for all heated piping applications up to 350 deg. F. and for low temperature applications of all types. On high temperature jobs it can be used as the second layer of insulation.—*Gustin-Bacon Mfg. Co., 210 West 10th St., Kansas City, Mo.*

Flexible Plastic Pipe Now Is Measure Marked B

Flexible polyethylene pipe in sizes from ¼ to 6 in. now comes measure marked at exact 10 ft. intervals throughout the coil. Inventories can be taken with ease by a quick visual observation. In the field, installations are speeded up. The measurement can be quickly calculated to a fraction of an inch with an ordinary pocket rule.—*The Plastex Pipe and Extrusion Co., Columbus, Ohio*

Nylon Nozzles Withstand Severe Use C

Nylon nozzles on a pulp cleaning device have run up a good performance record for withstanding abrasion and chemical attack. Rate of wear is described as "extremely low" in the presence of caustic, complex wood acids and dilute sulphuric acid. Location of the nozzle keeps it constantly immersed in the pulp and paper stock where it is subject to abrasive and corrosive wear.—*The Polymer Corp. of Pennsylvania, Reading, Pa.*

Fiberglas Baffles Reduce Noise Level D

Installation of acoustical ceiling material is frequently impractical around industrial areas because of obstructions like monorails, bus bars, sprinklers, lighting fixtures, pipes or girders. Such obstacles are no longer a deterent to proper noise reduction. Noise-stop baffles of plastic-encased fiberglas can now be hung on wires over the area like so many clothes on wash day.

Baffles are made of fine glass fibers bonded with a thermo-setting binder to produce a rigid panel 24x48x1½ in. An opaque plastic film encloses the panel. Stainless steel wires inserted through the board are formed into a hook at the top and secured to the top and bottom with stainless steel saddles.

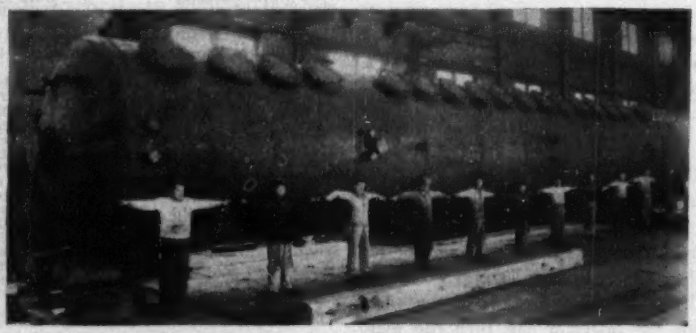
Baffles are installed on parallel wires stretched over an open area. Wire spacing varies between 3 and 7 ft. assuring adequate flexibility.

Sound waves striking the baffle surfaces are transmitted by the diaphragmatic action of the plastic film to millions of tiny dead air pockets between the glass fibers. In this way most of the sound energy is quickly absorbed. —*Owens-Corning Fiberglas Corp., Toledo 1, Ohio.*

Aluminum Floor Grating Finds Widening Usage E

Resistance to salt water corrosion originally gave aluminum alloy grating its start for walkways on tank ships. Since it is also highly resistant to other types of corrosion its use has spread to the chemical industry. Being light in weight it is easily removed for cleaning and to permit access to equipment. Its spark proof qualities make it ideal for hazardous locations.

Grating is mill extruded in 6 in. sections and welded into panels as specified by the customers. Stair treads are also available in 4, 6 and 9 in. widths.—*Washington Aluminum Co., Knecht Ave. and Pennsylvania R. R., Baltimore 29, Md.*



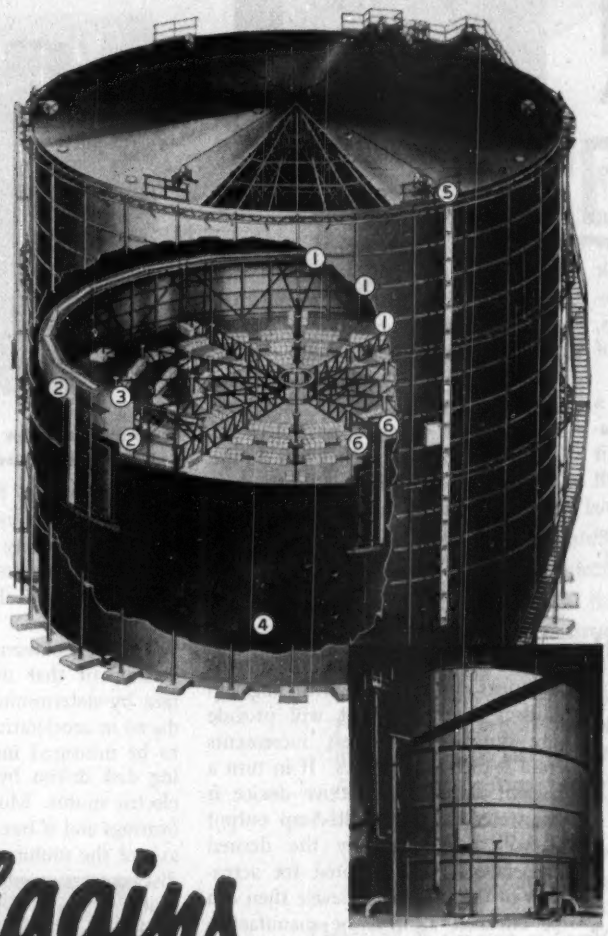
LEAD CLADDING PROTECTS PETROCHEMICAL TOWER (F)

The acid resistance of lead and fabricating versatility of steel have been combined in this Ferrolum lead clad steel tower for the petrochemical industry. It's the largest lead clad vessel to date to come from the shops of Knapp Mills, Inc. Vessel is 72 ft. long, has a diameter of 11 ft. and weights over 50 tons.—Knapp Mills, Inc., 23-15 Borden Ave., Long Island City, N. Y.

GUIDES TO GASHOLDER PLANNING

no. **1** *of a series*

"Will our gasholder be efficient? Safe? And . . .



1 Top section of shell completely ventilated

2 Wide clearances simplify operation

3 Gas-tight friction-less seal not affected by weather

4 Piston rests on bottom—less than ½ of 1% for purging

5 Leveling device—independent of side-wall—keeps piston level

6 Fenders prevent all tension in seal

How much does maintenance cost?"

Recently one of our engineers asked the chief engineer of a large corporation, "What are maintenance costs on your Wiggins gasholders?"

"Maintenance—what maintenance?" was the answer. "Since they were installed a year ago, no one's had to *look* at our Wiggins gasholders! What used to be maintenance expense now goes into profit!"

Wiggins' engineers get the same answer at practically every installation they visit: no operating costs, little or no maintenance costs.

Reason: the Wiggins' patented *dry* seal is permanent, impermeable and weatherproof . . . flexible, yet strong as steel. No need for constant checking on toxic or explosive gas accumulations. No anti-freeze or evaporation worries as with liquid seals. No complex rigging to corrode or get out of order. For complete facts, write General American.

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Portable Unit Spots Coating Holidays **A**

Holidays in pipe and tank coatings are detected with ease using the new SPI holiday dector. Models are available for testing either pipes or tanks.

Location of holidays is spotted by a spark which the operator notes both visually and audibly. The signal remains in action for several seconds, thereby emphasizing the location of a small holiday.

Holiday signal is controlled by a small cold cathode gas-filled tube capable of instant action. Power circuit is designed to give higher output with a smaller current drain on the batteries.—*Standard Pipe Protection Inc., 3000 South Brentwood Blvd., St. Louis 17, Mo.*

Vacuum Gage Has Increased Range **B**

Representing a refinement of earlier models, the Type 511 Alphatron vacuum gage incorporates a greatly increased range. Linear indications of total pressure are provided between 1,000 mm. and 10^{-4} mm.

Principle of operation is related to the conventional hot filament ionization gage. However, the Alphatron gage employs a shielded radioactive source rather than a hot filament. Alpha particles ionize the gas. Ionization current produced is measured by a d.c. amplifier calibrated to give absolute pressure in mm. of mercury. Trouble from fluctuating power supply has been eliminated by the use of batteries.

Accuracy is plus or minus 2 percent of full scale. Speed of response to pressure changes is instantaneous, making the gage useful as a leak detector. Unit is attached to the vacuum system by a ¼-in. standard pipe thread. —*National Research Corp., 70 Memorial Drive, Cambridge, Mass.*

Electrical Protection Checked by Instrument **C**

Failure of electric circuit protective devices causes heavy industrial loss each year. More important even than damage to equipment is the loss in time and production.

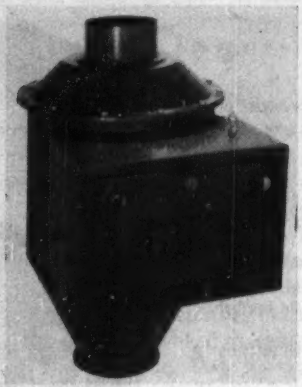
To help industry avoid such losses the industrial Multi-Amp has been developed for checking protective devices to establish that they will do the job required. With this instrument circuit breakers, overload relays and other current-actuated devices can be tested before installation, after installation and periodically after they are in service.

To operate the Multi-Amp you merely plug it into any convenient electrical outlet. Then with fingertip control the instrument will provide any output in stepless increments from 0 to rated amperes. If in turn a current actuated protective device is connected to the Multi-Amp output it will receive exactly the desired amperage. Time required for actuation of the protective device then can be checked against the manufacturer's time-current curves.—*Multi-Amp Corp., Harrison, N. J.*

Two-Speed Chart Drive Details Process Trouble **D**

Now you can have a detailed record of process trouble through use of a new two-speed chart drive. When a variable exceeds predetermined limits chart speed instantly increases to 30 or 60 times the normal rate. When normal conditions return chart speed drops to its usual pace.

Mechanism is designed for use in Honeywell's single record strip chart instruments. Single speed instruments already in use can be converted in the field where added versatility is desirable. A manual switch permits speed changes for precise charting of new process tests, or whenever a more open and legible record is needed.—*Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.*

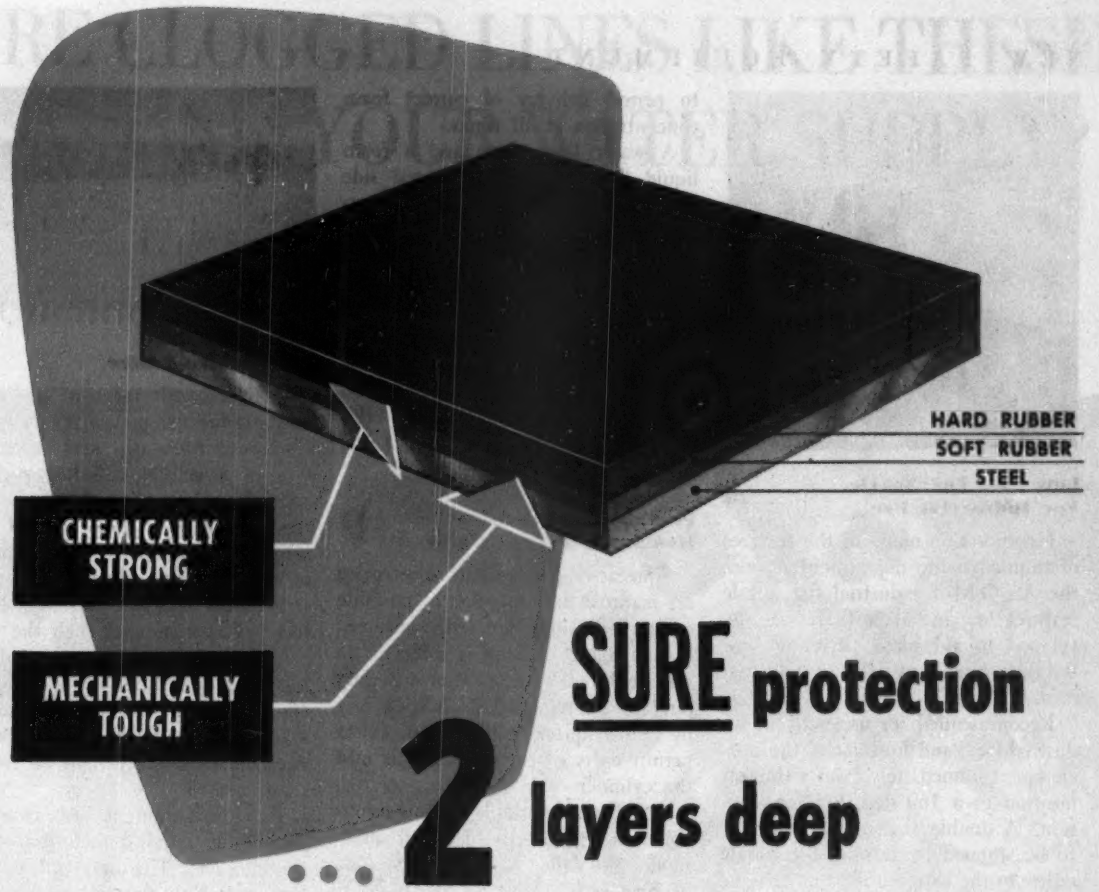


Meter Measures Solids Mass Flow **E**

Mass flow rates for free-flowing dry solids are given by the Massometer. Maximum capacity is 225 lb. per min. Instrument is accurate within 1 percent from 10 to 100 percent of capacity.

The Massometer is a force balance instrument that measures mass flow rate by determining the torque produced in accelerating the flow. Stream to be measured impinges on a rotating disk driven by a constant speed electric motor. Motor is supported in bearings and is free to move about the axis of the motor shaft. Load on the disk creates reactive torque on the motor housing which is directly proportional to the flow of material through the meter.

Torque is measured by a pneumatic relay operating on the "flapper and nozzle" principle. Output of the pneumatic relay is proportional to material flow and is measured by a circular chart pressure recorder. Recorder may be provided with an integrator.—*Wallace & Tiernan, 25 Main St., Belleville, N. J.*



SURE protection ... 2 layers deep

The only surface exposed to corrosives in an ACE hard rubber lined tank or pipe is the top layer of smooth, age-proof hard rubber — resistant to almost every acid, alkali, and corrosive salt. Underneath is a layer of shock-resistant soft rubber that firmly bonds the hard rubber to the steel — a bond so strong the rubber can't be peeled off, and won't loosen or blister. There's extra protection at the seams, and in the well-rounded fillets and corners. Flanges, too, are rubber faced. It's details like these that make one tank last longer than another — that make ACE rubber-protected equipment the finest you can buy.

ACE PLASTICS

In addition to hard rubber and rubber-lined tanks, valves, pipe, molded parts, etc., we also offer corrosion-resistant equipment of many plastics such as Saran and Parian. We'll be glad to recommend the *one best* material for your job.

WRITE FOR BULLETINS

ACE rubber and plastic products

AMERICAN HARD RUBBER COMPANY
93 WORTH STREET • NEW YORK 13, N. Y.

Low Cost Fog Nozzle For Industrial Use **A**

Incorporating many of the features of municipal fire department nozzles the Akr-O-Mist industrial fog nozzle features low initial cost. It was developed to aid plant personnel and fire departments in fighting industrial fires.

Recommended for use with all industrial hose and hose racks, the nozzle opens immediately from a shut-off position to a 160 deg. full fog position. A double shut-off permits flow to be stopped by turning the nozzle either to the extreme right or extreme left.

Vapor from the nozzle has the advantage of preventing extensive water damage to plant equipment and inventory such as caused by a heavy, solid stream of water. It smothers fires quickly preventing flash back and providing a protective screen that shields the fire fighter.—*Akron Brass Mfg. Co., Dept. OH, Wooster, Ohio*

Bulletin Board Flashes Safety Message **B**

Safety posters, messages and photographs can be made to attract attention through use of a new flashing bulletin board. Light from a 40-w. lamp flashing at the rate of fifteen times per min. shines through the posters. Two surfaces at right angles permit accommodation of two posters at the same time.—*Industrial Products Co., 2820 North Fourth St., Philadelphia 33, Pa.*

Foam Truck Meter System Proportions Foam Mixture **C**

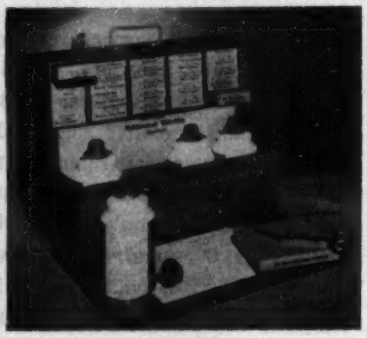
A fire-fighting foam truck is now equipped with suitable flow meters to permit delivery of correct foam concentration at all times.

A water line meter and a foam liquid line meter are mounted side by side. To obtain correct proportioning the operator turns the valve in the liquid foam line until that flow meter indicator is at the same height as the indicator of the water flow meter. When the two indicator levels match, the foam liquid is added to the water in the proper proportion, regardless of the amount of water being pumped.—*National Foam System, Inc., West Chester, Pa.*

Portable Extinguisher Has Squeeze-Type Valve **D**

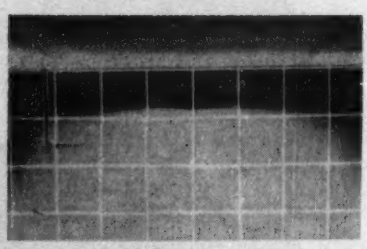
Squeeze-type valve and lower price are featured in a new line of portable carbon dioxide fire extinguishers. Normal hand pressure is sufficient to actuate the extinguisher after the safety pin has been removed. Recharge is easy by simply squeezing the valve open to permit entry of the recharge gas into the cylinder.

Frye-Freez portable extinguishers come in 2½-, 5-, 10-, 15- and 20-lb. models.—*Walter Kidde & Co., Inc., 40 East 34th St., New York 16, N. Y.*



Burn Spray Kits Have Aerosol Dispensers **E**

Now you can treat burn injuries rapidly and effectively without touching the affected areas. A new line of first aid kits for burns is fitted with aerosol dispensers for applying soothing and protective solutions. Dispensers contain 4 oz. of solution which is sufficient to treat the most extensive burns. Also included are bandages, compresses and scissors. Kit has dirt and moisture proof construction of 20 gage steel.—*Medical Supply Co., 1027 West State St., Rockford, Ill.*



Sprinkler Head Douses Fire Faster **F**

Increased effectiveness in extinguishing fire and preventing its spread is claimed for a new spray sprinkler. Use of a special deflector prevents water from being directed at the ceiling. A higher proportion of fine droplets are produced and distributed in a wide, evenly filled pattern.

Whereas standard sprinkler deflectors put approximately half the water on the ceiling, the new spray deflectors use the available water more efficiently. Approximately twice as much water spray is placed where it does the most good, right on the fire location.

Fast dissipation of heat is accomplished by rapid evaporation of the fine droplets. This helps prevent ceilings and other materials near the fire being raised to combustion temperature.

Sprinkler has been approved by the Factory Mutual Research Laboratories and listed by the Underwriters' Laboratories, Inc.—*Grinnell Co., Inc., 260 West Exchange St., Providence, R. I.*

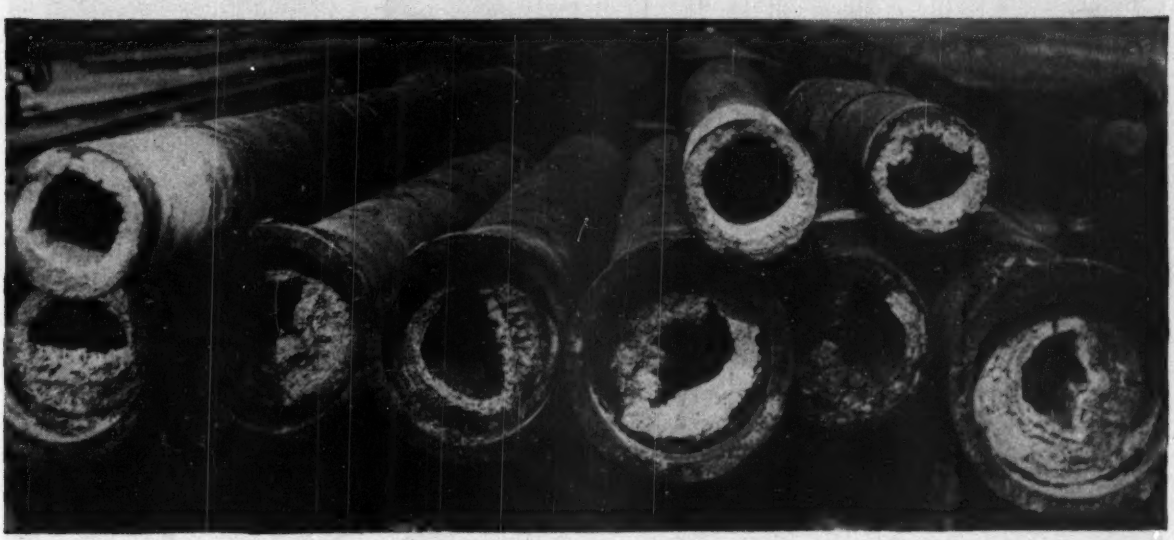
(G) **Fog nozzle** for hose gives better reach and coverage and better atomization at lower pressures. Models G10 and G15 are offered for two different capacity ranges.—*Bete Fog Nozzle, Inc., 85 Pierce St., Greenfield, Mass.*

(H) **Goggle cleaning fountain** with foot treadle permits workers to quickly and easily clean goggles, safety glasses and plastic face shields.—*Haws Drinking Faucet Co., Berkeley 10, Calif.*

(I) **Automatic shutoff safety valve** acts like a standard sprinkler head. Valve is used on both gas and liquid lines, carrying fuels and process materials.—*Valco, Inc., 1410 West St., Cincinnati 15, Ohio.*

ARE CLOGGED LINES LIKE THESE CUTTING YOUR WATER SUPPLY?

Over 1½ Miles of Buried Water Line Chemically Cleaned IN PLACE by Dowell Service



You don't have to dig up water lines in order to clean them! Take the case of a major railroad that had over 8600 feet of *buried* water lines, ranging from 2 to 12 inches in diameter. The capacity of these lines had been greatly reduced by scale deposits. Dowell Service used liquid solvents to clean all the lines, *in place*, during a period of only six days with a minimum interruption in service.

Dowell Service offers *fast*, effective chemical cleaning of pipelines of all kinds—water lines, disposal lines and product lines. And, whether these lines are underground or above, indoors or out, no digging or dismantling is necessary. Dowell solvents are designed to dissolve the accumulated deposits, and are introduced through regular connections. Because they are liquid, Dowell solvents reach wherever steam or water can flow, cleaning places inaccessible to other methods—angles, curves, valves, complicated surfaces and hook-ups. *Experienced* Dowell engineers do the job using Dowell-designed truck-mounted pumps, mixers and control equipment.

Many other types of equipment can also be cleaned chemically by Dowell. If you have boilers, condensers, evaporators, bubble towers, water wells or other operating equipment where deposits are reducing capacity, let Dowell Service *save you time and money in maintenance cleaning!*

FIND OUT ABOUT CHEMICAL CLEANING! There are many places in your plant where Dowell Service can clean equipment faster and better than out-dated mechanical methods. Call your nearest Dowell office for a fact-filled book. Or write direct to Tulsa, Dept. **H33.**

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED
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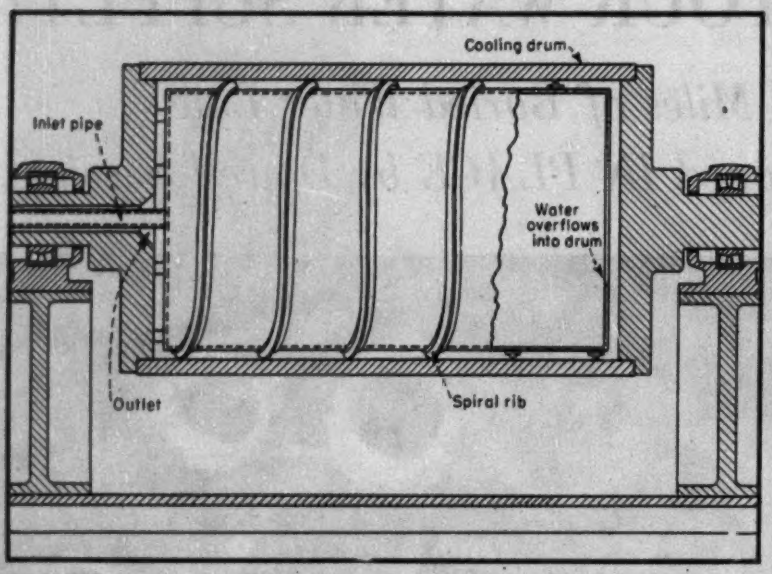
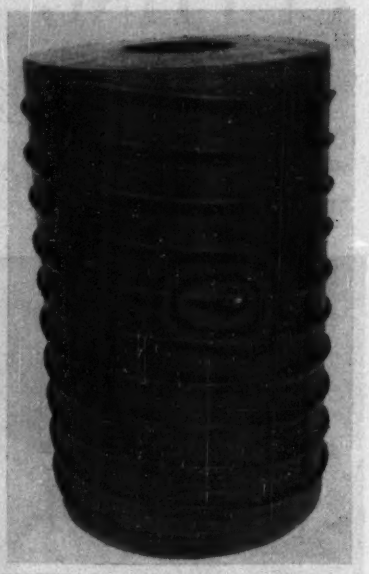


COOLING drum is more efficient when coolant flow is channelled by insert.



FLEXIBLE insert has spiral ribs.

New Twist in Heat Transfer

Flexible inserts and jackets with spiral ribs boost velocities of heat transfer mediums; give improved transfer rates and more uniform control. **(A)**

One way to open the throttle on heat transfer rates is by developing high fluid velocities across conducting surfaces. With the new Gross heat transfer insert or jacket this can be accomplished easily on existing equipment. Designed with flexibility for installation against heat transfer surfaces they provide flow channels that permit high flow velocities.

Significantly design of inserts and jackets can be varied to give optimum efficiency. On cooling applications water can be saved where supply is critical. If water is plentiful then attainment of high heat transfer rates can be the primary consideration.

Flow velocity can be stepped up where cooling medium is hottest near the end of its travel. Greater uniformity of heat transfer results and hot spots are eliminated.

High velocities slow down fouling of surfaces thereby stretching out the intervals between cleaning operations.

Inserts are made of hollow metal or flexible bag cores with flexible rubber ribs vulcanized to the exterior surface. Complete assembly can be pushed into a chamber or jacket. Pressing against the wall to be heated or cooled the ribs seal off channels to direct the fluid flow. In most installations the ribs are designed to give spiral flow channels. However, other flow patterns can be used. The ribs also can be built on irregular or flat surfaces.

Gross heat transfer jackets are made by vulcanizing the rubber ribs to the interior surface of the supporting core. Such units are suitable for strapping to the outside of tanks or pipes.

Installation of a Gross insert in a conventional cooling drum is depicted in the sketch above. Cooling water enters through a rotating union on the left and passes through the inner shell to the opposite end. There it overflows into the annular space formed by the inner shell and the cooling drum.

Rubber ribs on the shell make the water spiral back at high velocity effectively scrubbing the surface to be cooled. Pitch of the rubber spiral may be decreased at the overflow end to give higher velocity where the water is warmest.

Actual installation tests were made on a 30 by 48 in. Dilts cooling roll in a polyethylene laminator. At a roll surface speed of 400 fpm. the insert produced 26 to 35 percent greater heat transfer than the plain drum over a range of cooling water rates.

In a steam condensing test using a Pfaudler glass-lined condenser efficiency was increased 45 percent at 10 gpm. water rate and 31 percent at 30 gpm. These gains are based on comparison with a high velocity nozzle in the thimble normally used with the Pfaudler condenser.

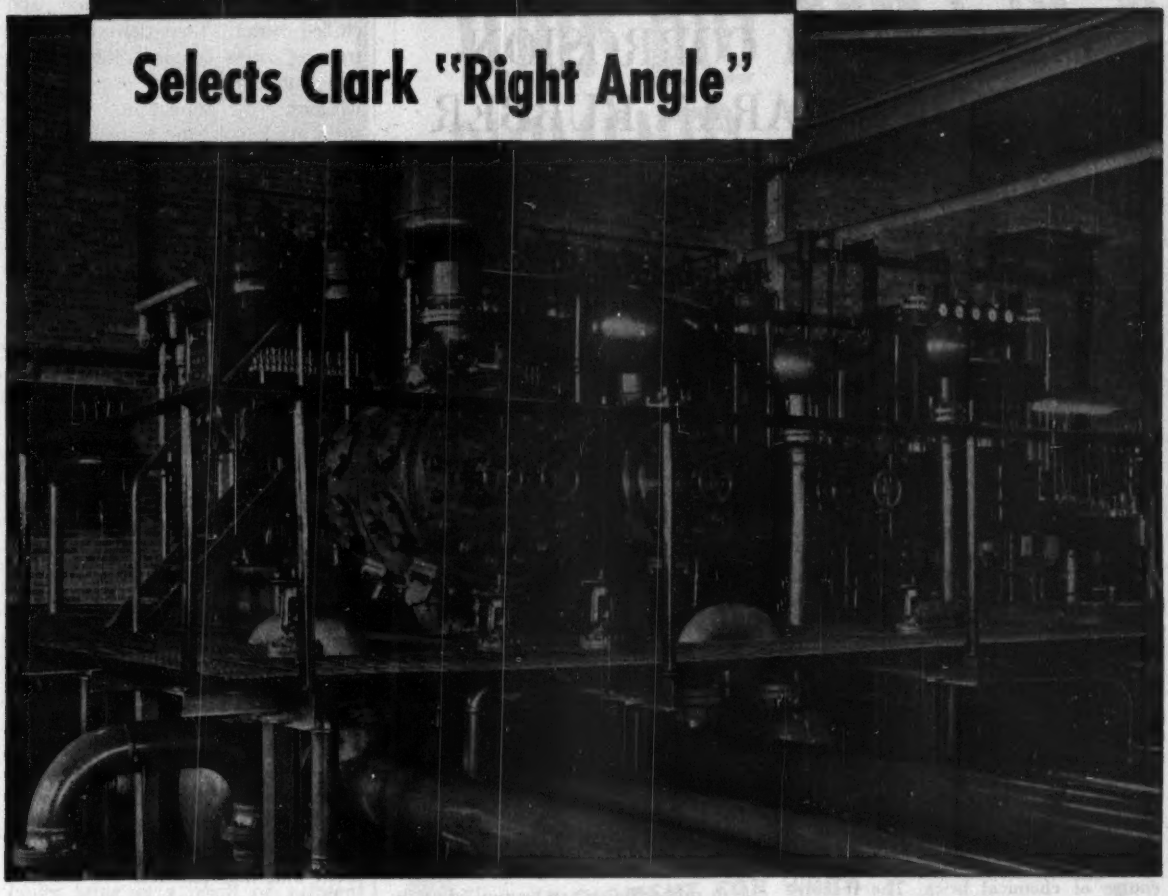
Tests are now under way to determine the service life of Gross units for heating applications. Steam pressures up to 20 psi. already appear practical within the limitations of the rubber compounds now available.—*Frank R. Gross, 592 Crestview Ave., Akron 20, Ohio*

Chemical Dehumidifiers Offered in Larger Sizes **B**

Faced with increasing demands for larger quantities of sub-freezing air Kathabar has extended its line of low temperature units to handle up to 17,000 cfm. in individual units. Increased air moisture-absorbing capac-

New Houston Oxygen Co. Plant

Selects Clark "Right Angle"



Major Industries supplied by World's first oxygen pipeline

Now, for the first time, large industrial plants are being supplied with oxygen via pipeline. A 3-inch, 3-mile line from the Houston Oxygen Company's new oxygen rectification plant has eliminated the hazards and high costs of handling individual tanks.

Playing the key role in the oxygen manufacturing process is an 1100 bhp, HSRA-8, Clark "Right Angle," Gas-Engine-Driven Compressor. Its versatility enables boosting air to 2350 psi in five stages of compression, using a single unit. Both initial costs and operating costs have thus been substantially reduced over a "two-unit train-type" installation.

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Whether your processing application is simple or complex, you can *always* depend on Clark for the right type of compressor. Clark builds *all* types.

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DOW

ETHYL BENZENE REACTORS LINED WITH CORROSION-RESISTANT SARAN RUBBER

Another example of how SARAN RUBBER tank lining helps cut cost of handling, storing or transporting corrosives

The ethyl benzene reactors pictured here have a saran rubber lining under one course of chemical brick. The reactors handle ⅓ ethyl benzene, ⅓ higher benzenes, ⅓ benzene and .3% hydrochloric acid. They have been in service for over three years without appreciable effect on the saran rubber lining in spite of the fact that they operate at a temperature of 110° C.

Saran rubber's high degree of chemical and abrasive resistance makes it the ideal lining for tank cars, storage tanks, tank trailers, processing tanks and other equipment handling corrosive acids, solvents, and other chemicals.

Saran rubber lining can be applied easily and economically by experienced saran rubber applicators located strategically throughout the country. We will be glad to advise you as to where and how saran rubber lining can be applied to your best advantage. Get in touch with your nearest Saran Lined Pipe Company office or write direct to The Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan. Offices in New York • Boston • Pittsburgh • Tulsa • Philadelphia • Chicago Portland • Indianapolis • San Francisco Houston • Denver • Los Angeles • Seattle Cleveland • Charleston, S. C. • Toronto Montreal.

Saran Lined Pipe Company
2415 Burdette Avenue, Ferndale, Michigan
Please send me your catalog on Saran Rubber Tank Lining and Saran Rubber Molding Stocks.
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Company_____
Address_____
City_____State_____

RELATED PRODUCTS

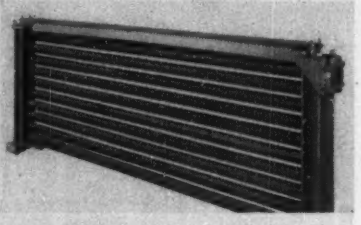
Saran rubber molded parts—stoppers, diaphragms, various-sized moldings for valves, instruments, etc.

Saran lined steel pipe—corrosion-resistant pipe that gives long-term operation with minimum maintenance costs.

you can depend on DOW PLASTICS

DOW

ity is gained through use in the cooling coils of refrigerants such as brine, methanol, Freon, ammonia and chilled water. Low dewpoint, subfreezing air is supplied continuously and automatically to process areas without frost formation. This assures maximum time for operation of low temperature processes.—*Kathabar Div., Surface Combustion Corp., Toledo 1, Ohio.*



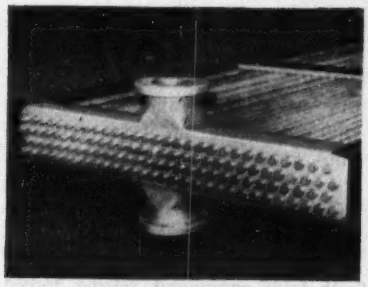
Graphite Cascade Cooler Has New Design Features

A Series CC Karbate sectional cascade coolers offer many new design features for extended range of application and increased effectiveness. Among these are type SN armored connections (no nozzles), radiused crossovers between sections for high fluid velocities with minimum pressure drop, high cooling water capacity, redwood water-guide strips with stainless steel clip springs, and Teflon gaskets that eliminate gasket replacement and maintenance.

Each cascade cooler is made up of single-tube cooler sections provided with block-type end fittings. When stacked with the block end fittings one upon another the sections form a series flow vertical bank. At the end of each horizontal run the block fittings are provided with radiused 90 deg. cross-overs for interconnecting with minimum pressure drop.

Steel weir-type water distributors are mounted on the top pressure plates. They can be adjusted to control accurately the water flow over the Karbate tubes. Snap-on water guide strips eliminate water loss.

Series CC coolers are recommended for service in practically all acids, caustics and organic solvents at pressures up to 75 psig. and temperatures up to 338 deg. F. Gases at considerably higher temperatures can be handled by making minor changes in the method of applying the cooling water. —*National Carbon Co., 30 East 42nd St., New York 17, N. Y.*



Air-Cooled Exchanger Gives Better Transfer A

More efficient cooling of liquids and gases at pressures up to 5,000 psi. and temperatures to 1,500 deg. F. is claimed for the new Fin-Fan air-cooled heat exchanger. New Transaire sections keep tube side pressure-loss low due to smoother flow surfaces at nozzle and tube openings. Tubes are spaced closer for compactness.

Tubes and tube spacers are designed for easier field repairs and simpler tube replacement. Patented process for fin to tube bonding keeps fins rigidly in place despite repeated expansion and contraction. Sections are selfdraining eliminating the necessity for raising one end for drainage. —*The Fluor Corp., Ltd., 2500 South Atlantic Blvd., Los Angeles 22, Calif.*

Boiler Fuel Changeover Is Rapid B

Easy, fast changeover from gas to oil, or vice versa, is now possible in boiler firing as a result of a recent development. No mechanical or electrical change is necessary. By simply flipping a selector switch on the control panel to either gas or oil the proper circuit is set in action. Turning the convenient fuel supply valves completes the entire changeover in 10 sec. or less.—*Cleaver-Brooks Co., 326 East Keefe Ave., Milwaukee 12, Wis.*

Packaged Boiler Comes Fully Assembled C

A new line of shop-assembled water-tube boilers operates in the medium pressure range (up to 250 psig.) with steam capacities ranging from 4,000 to 30,000 lb. per hr. Design of the VP boiler is based on the two drum vertical-bent-tube arrangement with a water-cooled furnace in front of the convection surface.

In the new unit there is said to be a higher ratio of furnace wall cooling to furnace volume than in any other

YOUR BIG NEWS IN PIGMENTS...WILLIAMS NEW KROMA RED !

Gives you far brighter mass color, much cleaner tint, is more easily dispersed than any red iron oxide pigment yet produced!

MEANS THAT YOU CAN NOW USE A LOW COST IRON OXIDE PIGMENT FOR WORK WHERE MORE BRILLIANT COLORS ARE REQUIRED FROM LIGHT RED TO DEEP MAROON

Chemical and Physical Properties	
Fe_2O_3	95.0% MIN.
Sp.G.	4.80
Oil ABS.	21-22
Hiding SQ. FT. per LB.	850-1,000

KROMA RED applications:

Toy and furniture enamels
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Automotive finishes
Camouflage (high infrared reflectance)
Rubber products
Plastics
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. . . and many other uses.

Write today for complete technical report on Kroma Red—entirely new iron oxide pigment. Address Department 3.

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108 SHADES AND TYPES OF IRON OXIDE PIGMENTS

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THERE ARE A LOT OF GOOD TRUCKS on the market, and a lot of good arguments for each. But this fact remains: more people buy CLARK gas powered trucks than any other make. Since we produce all power types . . . gas, electric, diesel and L.P. gas . . . we feel we're in a good position to explain why:
CLARK Horsepower Is Capacity-Rated To Your Requirements —Why pay for excess horsepower that you'll never use? CLARK gives you five engines, rated according to truck capacity. You get plenty of power for the job, without a lot of gas-consuming excess. When you buy a CLARK in the size that's right for you, you get the proper horsepower, too.
CLARK Flexibility Meets Any Work Condition — A wide range of speeds and a constant source of power enables your gas powered CLARK to handle any work condition. Flexibility means 'round-the-clock performance of normal operations, with a built-in reserve of power for peak loads and emergencies. And for long hauls, you can't beat the speed and economy of the gas powered CLARK. . . . . .
No matter what your handling requirements are—there's a CLARK machine to do the job. Electric or gas powered fork trucks, POWRWORKER hand trucks, industrial towing tractors—they all give you quality-value for your money. That's why industry buys more CLARKS than any other make of truck. When you're in the market for materials-handling equipment, talk to your local CLARK dealer first. Most people do!
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boiler of its size and type. This feature assures rapid and efficient heat absorption and lower gas temperatures entering the convection bank. It also results in less slag formation and aids in minimizing furnace maintenance.

Unit comes completely assembled with firing equipment, setting, forced draft fan and automatic control. The compact design requires a minimum of floor space and head room.—*Combustion Engineering-Superheater, Inc., 200 Madison Ave., New York 16, N. Y.*

Steam Valve Holds Seal on Cooling A

Built-in compensation for dimension change with temperature variation permits the Harper-Velan self-tightening valve to hold a tight seal at all times. Designed for high-pressure, high-temperature power service, this steel valve overcomes the disadvantages encountered with integral hard-faced welded seats.

An elastic seat ring is designed for slight downward movement or displacement when the valve disk is seated tight against it. Cooling of the parts, with attendant slight retraction of the valve disk following valve closure, does not open passage for leakage. Rather, the elastic seat ring maintains close contact with the valve disk.

Both seat and disk are reversible. This means double life for each of these parts. All parts subject to wear can be replaced without removal of valve from the line.—*Velan Engineering Co., 1 Exchange Place, Jersey City, N. J.*

Industrial Heaters Cover Wide Range B

An improved line of industrial heaters is now available for delivering large volumes of heated air to industrial plant areas. The self-contained unit may be either floor, wall, or ceiling mounted. Capacities range from 100,000 to 2,500,000 Btu per hr., and from 2,000 to 25,000 cfm. Accessories available include filter boxes for built-in mechanical air cleaning and air-mixing boxes for controlled mixing of fresh and recirculated air.—*Westinghouse Sturtevant Div., Dept. T-535, 200 Readville St., Hyde Park, Boston 36, Mass.*

(Continued)

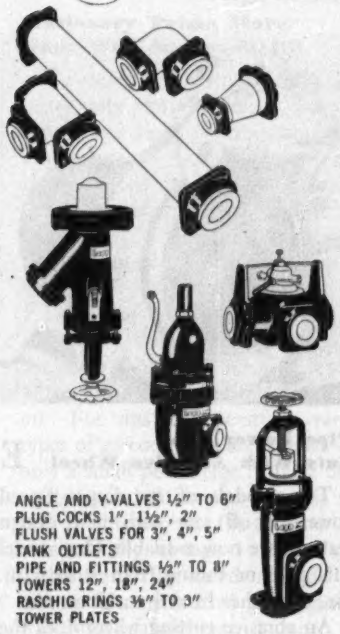
SAFEST way to handle acid corrosion

SAFE from corrosion

SAFE from contamination

SAFE for plant and personnel

Lapp CHEMICAL PORCELAIN



ANGLE AND Y-VALVES ½" TO 6"
PLUG COCKS 1", 1½", 2"
FLUSH VALVES FOR 3", 4", 5"
TANK OUTLETS
PIPE AND FITTINGS ½" TO 8"
TOWERS 12", 18", 24"
RASCHIG RINGS ⅜" TO 3"
TOWER PLATES

For problems involving severe corrosion, or elimination of contamination, best bet is a material chemically inert to product being handled—and it should be hard, smooth, strong, and non-porous.

That's a description of Lapp Chemical Porcelain—and a list of characteristics which have won it a permanent place in hundreds of plants, and hundreds of processes, where no other material ever gave as satisfactory service.

The bonus is that it costs a lot less initially than most corrosion-resistant alloys and lined equipment. And the economy is increased in the fact that it almost never needs maintenance or replacement.

We want to make special mention of the item "safe for plant and personnel." Lapp Porcelain is much tougher and stronger than most people give it credit for. However, under severe shock, physical or thermal, it will break. In the past we've supplied our equipment with several types of armor. Today, we've got the simplest, most economical, and best. We call it TUFCLAD. It consists of multiple layers of heavy fiberglass woven cloth, impregnated and bonded with an Epoxide resin. This armor shell acts as a cushion against impact damage, and insulator against thermal shock. But most important, it is of itself strong and tough—will hold line pressures even when porcelain is cracked or broken.

For your problem of corrosion or contamination, Lapp Chemical Porcelain may bring you a new standard of untroubled service, improved quality and lowered cost. Write for description and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 151 Wendell St., Le Roy, N. Y.

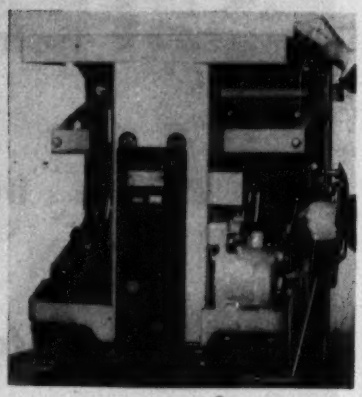
Pipe-Ends Cleaned in Seconds **A**

Pipe ends or threaded joints can be cleaned inside or outside in 6 to 8 sec. with a new high speed joint cleaner. Unit is designed to speed reconditioning of old or reclaimed well pipe and pipe lines. Pipes ranging from 2 to 10 in. can be handled.

The joint cleaner has an air-driven motor and a precessing head containing a spring-loaded brush guide and wire brush. Provision is made for shooting solvent or cleaning fluid onto the pipe end to dissolve any caked material. The precessing head revolves around the pipe end at 40 rpm. Unit weighs 16 lb. and is easily handled.—*Airetool Mfg. Co., 300 South Center St., Springfield, Ohio.*

Oil Drum Stand Gives Complete Drainage **B**

Recovery of that last drop of oil which may amount to several quarts is facilitated with a new tripod oil-drum drain stand. Pumps used to dispense oil from drums usually are unable to deliver the last few quarts remaining in the bottom. By inverting the drum over the screened opening of the drum stand you can recover this liquid heel. A faucet on the drum-stand reservoir permits feeding the oil into smaller containers.—*West Bend Equipment Corp., West Bend, Wis.*



Low-Voltage Switchgear Has Air Circuit Breakers **C**

A complete new line of low-voltage draw-out switchgear for 600 v. a.c. and below has been announced. This equipment has standardized compartment construction and completely new air circuit breakers.

Complete equipment can be manufactured to a specified circuit pattern using standardized circuit breaker, control-instrument and bus compartment building blocks. Faster delivery can thus be attained.

Able to withstand 30 cycle momentary currents equal to their interrupting rating (15,000 to 100,000 amp.), the new air circuit breakers make possible, for the first time, fully selected tripping with all breakers applied up to their full interrupting ratings. Continuous current ratings for this device range from 15 to 4,000 amp.

An important feature of the new breakers is the stored energy closing mechanism used for electrical operation of 50-, 75- and 100-kva. interrupting rated breakers. The new mechanism insures closing and latching against full rated short-circuit current even though control voltage is completely lost when the breaker contacts first touch.

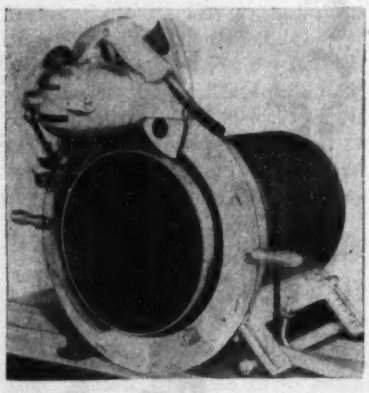
All breakers are equipped with triple-characteristic over-current tripping devices which provide long or short time delay, or instantaneous characteristics as required for different applications.—*General Electric Co., Switchgear Dept., Schenectady 5, N. Y.*

Plastic Gloves Can Now Be Recapped **D**

Here's a new angle on waste reduction. It concerns those plastic dipped cotton workmen's gloves that are so widely used throughout the industry.

Don't discard those worn and damaged gloves for now you can have them reconditioned to good-as-new. It is estimated that 90 percent of gloves now discarded can be returned to service.

Reconditioning includes cleaning, sterilizing, patching and repairing, reshaping, recoating, vulcanizing and pairing. Cost is a fraction of new glove cost. Pick-up and delivery service is offered through 57 outlets in 20 states.—*U. S. Industrial Glove Corp., 9350 Roselawn, Detroit 4, Mich.*

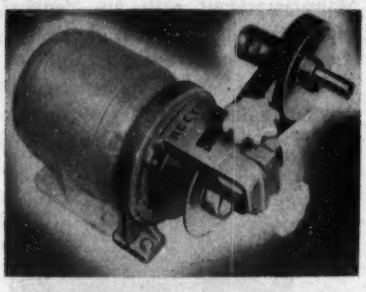


Pipe Power Saw Cuts With Abrasive Wheel **E**

Two models of the Super Speed power cut-off saw with new design features are now available. One model cuts pipe or tubing from ¼ to 6 in. dia.; the other from ¼ to 12 in. dia.

An abrasive cutting wheel does the cutting job. The cut surface is square and non-distorted without misalignment or burrs. During the cutting operation the pipe is held firmly while

the saw assembly rotates around it.—*Tri-Clover Machine Co., Kenosha, Wis.*



Variable Speed Drive Is Flexible and Low Cost A

Designed for drives of 1 hp. or less, the Flexi-Speed variable speed drive unit is said to combine low unit cost with unmatched flexibility in operation and application. These units may be mounted in almost any position around the driven equipment. They can drive in any direction; deliver any desired speed within a ratio of 8 to 1.

The speed control handwheel may be located parallel to or in any of eight positions perpendicular to the motor shaft. Six different belt lengths offer a wide choice of shaft center distances.

Flexi-Speed drives are presently available in ½, ¾ and 1-hp. capacities. —*Reeves Pulley Co., Columbus, Ind.*

Stationary Prime Mover Runs Well on Gas or Oil B

To meet increasing demand for heavy duty prime movers of moderate weight and small physical dimensions a new series of 4-cycle V-type engines is announced for stationary services. These Supairthermal engines are built in 12 or 16 cylinders covering a range from 2,400 to 4,260 hp. at 450 to 600 rpm.

Units are designed and built for liquid fuel, duafuel or spark-fired gas operation. As a diesel, the engine burns a wide range of fuel and crude oil. For duafuel operation, various types of gaseous fuels are burned with only a small percentage of pilot oil to control combustion. In case gas supply is interrupted the engine will automatically change to liquid fuel without affecting speed or load. Operating as a spark fired gas engine, it will burn natural gas, butane, propane, manufactured gas and sewage gas using a dual spark ignition system.

All the performance features of the manufacturer's in-line engines have

HOKE
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Opened or closed with a single, positive motion—like a light switch—these HOKE toggle valves will improve the design of your instrument panel or test stand. Use them to control gas or liquid, at pressures up to 1000 psi or in high vacuum, with no leakage through stem or seat. They are available in ⅛", ¼", ⅜" and ½" sizes, in brass or stainless steel. The seat material, normally synthetic rubber, may be altered to meet specific conditions. Both straight line and angle type are ideal for instrument panel installation and can be mounted easily and securely with a lock nut. Several types are available with plastic knobs of various colors, for quick identification of fluids. For fingertip fluid control—for time-saving, dependable, efficient performance—specify HOKE Toggle Valves. Write Hoke Inc., 139 S. Dean St., Englewood, N.J., for Catalog & Data Sheets.

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Announcing SUNOCO PETROCHEMICALS!

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Product	What it is	Suggested Uses
Sulfonate WS	A low-cost water soluble petroleum sulfonate.	Wetting, air-entraining, foaming, rewetting and ore flotation agent.
Sulfonate OS	A low-cost, highly purified oil soluble petroleum sulfonate.	Detergent and lube oil additives. Surface active agent.
Sunaptic Acids	High mol. wt. naphthenic acids, with unusually low percentage of unsaponifiables.	Driers, emulsifying and flotation agents. Used in preparation of esters, plasticizers and preservatives.
PDO-40	A polymerized, closed-chain hydrocarbon. Dries at room temperature; resists water, alkalies, dilute acids; good color stability; soluble in mineral spirits.	Corrosion resistant surface coatings, metal primers, aluminum bronze vehicle, concrete curing compounds, core oils, and reclaiming agent for rubber.
Propylene Trimer and Tetramer	Commercial grade C_9 and C_{12} mono-olefins.	Synthetic detergents and chemical intermediates.

A Sun representative will gladly discuss these new Sunoco Petrochemicals with you. Or you can get technical data and samples for test purposes. Write SUN OIL COMPANY, Phila. 3, Pa., Dept. CE-8

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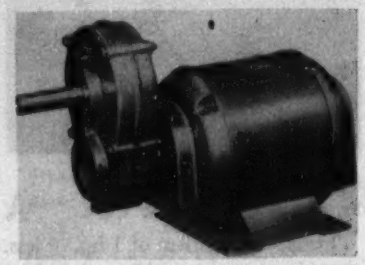
been incorporated in the V series. Many important parts are identical and interchangeable with the in-line type of engine.—*Nordberg Mfg. Co., Milwaukee 1, Wis.*



Speed Reducer Slips Onto Motor Shaft **A**

Electric motors can now be converted to geared motor type reducers at a minimum cost. Model 3R3 Uni-Reducer slips onto the motor shaft eliminating the usual coupling between motor shaft and reducer.

Designed to fit standard motors from 1 to 5 hp., 1,800 rpm., and 1 to 3 hp., 1,200 rpm. the unit has a reduction ratio of 3.04 to 1. A torque arm take-up eliminates the need for slide rails.—*Turner Uni-Drive Co., 3400 Terrace St., Kansas City, Mo.*

Tube Cleaner For Medium Sizes **B**

Heat exchanger tubes between ½ and 1¼ in. O.D. can be cleaned with the new model PGX cleaner. Unit is suitable for both horizontal and vertical applications.

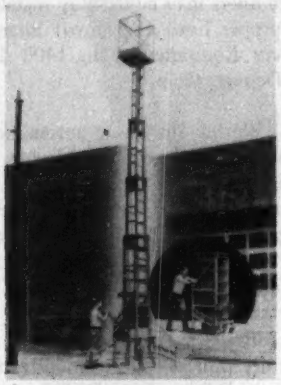
The PGX cleaner is classed as a positive drive, high speed, hollow rotary shaft, air driven, scavenger drill type cleaner using carbide tipped bits. Air consumption is approximately 70 cfm. at 90 psi. Maximum power is derived at 90 psi. operating at approximately 3,500 rpm. Unit weighs 8 lb. and is only 11 in. over-all.—*Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N. Y.*

Tube Expander Speeds Rolling Operation

Expansion of tubes into thick tube sheets or steam drums has been speeded up by a new fully automatic controlled retractive method. It is said to eliminate step rolling in thick sheets reducing tube rolling time by doing the complete job in one operation.

Overexpansion which leads to unnecessary enlargement of the tube holes is prevented. Also compressive loading and bending of the tubes is avoided.

In operation the retractive method draws metal toward the tube mouth causing elongation in that direction. The expander is inserted into the tube and the far end of the tube is expanded to the desired tightness. Automatically the motor stops, reverses and retracts the expander through the tube.—*The Airetool Mfg. Co., 300 South Center St., Springfield, Ohio*



Adjustable Work Tower Fits Tight Spots **A**

A new work platform that telescopes up and down has removable outrigger legs for greater stability. Leveling screws aid set-ups on uneven locations. This makes it ideal for all overhead maintenance work such as painting, lighting and cleaning. Scaf-Fold comes in one piece that is easily rolled into position and raised.—*Atlas Industrial Corp., 849-39th St., Brooklyn 32, N. Y.*

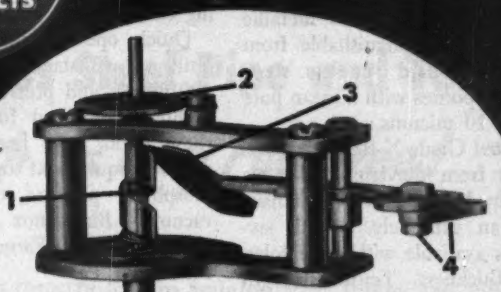
(B) Welding electrode for general use constructed of mild steel assures a high ratio of inches of welding to inches of electrode used. Designated as Type W-610-A, electrode is a d.c. reverse polarity rod, meeting AWS Class E-6010 specifications.—*General Electric Co., Schenectady 5, N. Y.*

(C) Masonry drill is designed to avoid stalling from dust packing. Proper combination of oval flutes, narrow lands, and fast spiral carries dust up and out of hole as fast as it forms. Drill is made of tough alloy steel tipped by Carboloy.—*Holub Industries, Inc., Sycamore, Ill.*

(Continued)

ACCO products

HELICOID GAGES



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4. Corrosion-resistant link and screws

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HELICOID Gages are particularly desirable where pressures fluctuate and cause excessive movement and wear of gears in ordinary gages. The smooth operation of the durable HELICOID cam and stainless steel roller keeps the pointer as steady as it was originally even after hundreds of thousands of cycles.

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NEW PROCESSING EQUIPMENT

Metallic Filter Sheet Is Smoother and Stronger — A

To the naked eye a new metallic filter sheet is indistinguishable from a sheet of standard stainless steel. Actually it is porous with a mean pore opening of 10 microns.

Designated Grade X the new material differs from previously available materials by having twice the tensile strength, an extremely smooth surface and is available with close tolerances on thickness. Tensile strength is approximately 25,000 lb. per in. It is more ductile than previously available porous stainless steel filter sheet.

Sheets 0.040 in. thick are now in stock. Other thicknesses from 0.020 to ¼ in. can be furnished on short notice. Material can be fabricated into all forms in which porous stainless steel has hitherto been furnished. —*Micro Metallic Corp., 35 Sea Cliff Ave., Glen Cove, N. Y.*

Grinding Mill Line Adds Midget Size — B

Latest addition to the Morehouse line of grinding mills is a unit designed for laboratory processing and control work. This gives the plant man a machine for formulation and control work prior to starting large scale volume production. Throughput rates vary from 1 to 3 gal. per hr.

Weighing only 41 lb. the mill stands 23¾ in. high and has a 8¼ in. diameter. Grinding is done by a Carborundum stone revolving at high speed against a stationary Carborundum stone. Clearance can be varied in 0.001 in. stages by a simple hand wheel control. A highly polished processing chamber permits easy cleaning. Power is supplied by a ¾ hp. motor.—*Morehouse Industries, 1156 San Fernando Rd., Los Angeles 56, Calif.*

Pressure Vessel Door Opens in Seconds — C

Operations requiring the use of pressure vessels can be speeded up with a new quick opening door. An expanding-contracting split-ring closure slashes door opening time from 20 or 30 min. to 30 seconds.

Already the new door is finding ready acceptance for rubber vulcanizers, plastic-glass bonding vessels, wood impregnators, and concrete block curing chambers.

Quick opening doors have been built to withstand temperatures to 400 deg. F and pressures to 300 psi. Although designed for pressure use these doors have been adapted for use on equipment operating at atmospheric pressure or under high vacuum.—*Blaw-Knox Co., Process Equipment Div., Farmers Bank Bldg., Pittsburgh, Pa.*

Dyeing Machine Boosts Efficiency — D

Lower cost textiles and clothing are expected to result as a new dyeing machine comes into use. Faster dyeing with decreased color consumption and less machinery space are claimed for the equipment.

Through-put rate varies from 20 to 120 yd. per min. depending on the type of fabric and class of dyestuff used. Fabrics dyed on the machine so far include cotton, wool, rayon, acetate, nylon, orlon and dacron thereby indicating its versatility.

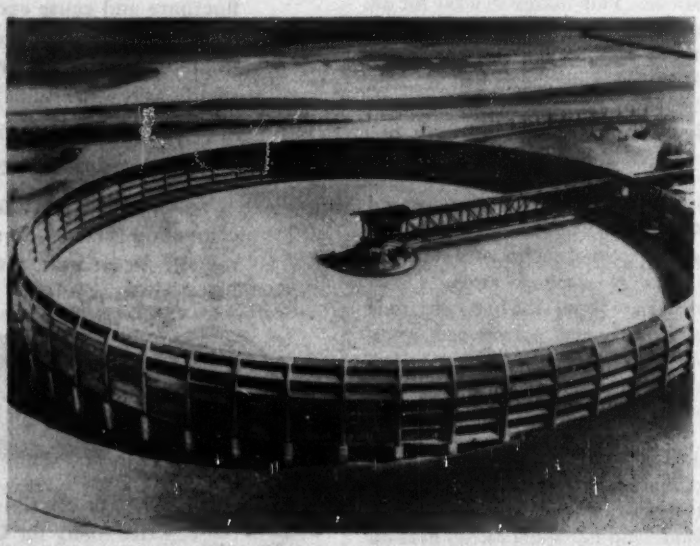
The machine is still in the development stage, but full-sized models are being built.—*Hussong-Walker-Davis, Valetta & Coral Sts., Philadelphia, Pa.*

Ball Mill Has Wide Variability — E

Wide flexibility for use in small milling plants or as a regrind mill makes the improved Denver convertible ball-rod mill a noteworthy piece of equipment. This 30 in. diameter mill can be increased in length from 18 to 72 in. by 18 in. increments according to process needs. Size of the trunnion discharge opening can be changed readily merely by installing the correct throat liner. Grate liners may be used by installing the proper head and throat liners.—*Denver Equipment Co., 1400 17th St., Denver, Colo.*

(F) **Chlorine dispenser** automatically controls and mixes chlorine gas with water. Corrosion-resistant materials provide complete protection against internal corrosion.—*Fischer & Porter Co., 10 Jacksonville Rd., Hatboro, Pa.*

(G) **Automatic sampler** works on wet or dry process streams. Cutter travels on ball-bearing wheels across 21 in. track. Motor driven time switch controls sampling at intervals from 2 to 55 min. in one min. intervals. Denver Equipment Co., 1400 17th St., Denver 17, Colo.



THICKENER SCREEN DEFLECTS WIND TO IMPROVE SETTLING

Use of this wind screen at the Palliser Works, Durham, England, prevents wind interference with normal thickener operation. This 240-ft. thickener, the largest operating in England, is installed on a magnesia from sea water operation.—The Dorr Co., Barry Place, Stamford, Conn.

Stainless Steel Pipe and Tubing

with its own Pedigree!

Republic ELECTRUNITE Enduro Stainless Steel Tubing and Pipe are stenciled for *your* positive identification prior to use.

Warehouses and their customers especially are interested to know that ELECTRUNITE Stainless Steel Tubing and Pipe are stenciled with the name ELECTRUNITE, the type, heat number and applicable specification number. Where specifications are the customers', or are required by the military, this same information appears.

This marking is done on a special stenciling machine built to Republic specifications. Ink used is the permanent type. Lettering is large and legible. Where tube diameters are too small for legible lettering, a suitable identification tag is attached to each bundle.

ELECTRUNITE Stainless Pipe and Tubing is stenciled the entire length. No matter where it's cut, it can still be identified. When you check a shipment, it's easier. When you trace one, it's simpler.

But more than this, these stencils are marks of Republic ENDURO quality. The heat number means Republic has all the information on file back to where the ingots began. Republic knows what happened all along the way to make each piece as good as stainless can be.

Next time you order stainless steel pipe and tubing, make sure it's ELECTRUNITE. You'll get the top quality in stainless steel from Republic, the company which pioneered this metal of over 10,000 uses.

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STAINLESS STEEL TUBING AND PIPE

All Metal Filter Clarifies Petro Products **A**

Utilizing a porous metal filter medium a complete line of industrial filters has been developed for applications in the petroleum industry. Filters with the Filterall element are said to remove all contaminants over 2 microns in size from any liquid with minimum pressure drop.

Filterall elements are made of carefully sized spherical metal particles sintered under controlled atmosphere. Porosity of the resulting structure is dependent on the size of spherical particles used. Elements can be completely rejuvenated by simply washing in gasoline, kerosene or industrial cleaning solvents.

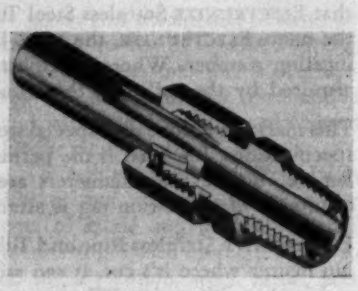
Sizes range from small units used for lubricating and hydraulic oil systems to 600 gpm. units for bulk diesel fuel, gasoline and jet fuels.—*Permanent Filter Corp., 2309 Riverside Dr., Los Angeles 39, Calif.*

Vacuum Pumps Attain Mobility **B**

Vacuum pumps are now available as truck mounted units for use as emergency or test equipment. Furnished in two models, the smaller handles more than 2,000 cfm. between 1 and 10 microns absolute pressure; the larger more than 4,000 cfm. between 1 and 10 microns absolute pressure.

The 2,000 cfm. model, 147-E-10, consists of one Model 212-G Microvac pump, one Model 147-E-10 diffusion pump, one Model 211-10 high-vacuum valve, one ½-hp. hermetically-sealed refrigeration unit with baffled cold trap coil. All auxiliary piping, valves and electrical controls are mounted on the unit's common base. Connection for purchaser's manifold is standard 10-in. pipe flange having a center line 42 in. above the floor. The steel base is equipped with self-leveling jacks.

For the roughing stage in vacuum operations, the 115-cfm. mechanical pump provides rapid pulldown. For intermediate pressures the diffusion pump's broad range obviates the necessity of a booster pump. In the lowest ranges the almost double capacity of the diffusion pump is bonus protection for extra loads.—*F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*



Tube Fittings Eliminate Special Tools **C**

Sections of tubing can be joined together with the Ermeto tube fittings without the use of flaring, threading, welding or soldering. The tubing requires no special preparation, nor are special tools required to complete the installation.

A sleeve, nut, and tapered body comprise the Ermeto fitting. As the nut is tightened it forces the sleeves forward into the taper of the body. The leading edge of the sleeve contracts, forcing the cutting edge to shear a slight groove into the outer surface of the tubing. This provides a leakproof joint. Pressure of the nut on the bevel of the sleeve results in a tight positive grip on the tube.

When fully tightened the sleeve is bowed slightly at the mid-section, causing it to act as a lock washer. This locking action maintains constant tension between body and nut, preventing the nut from loosening.

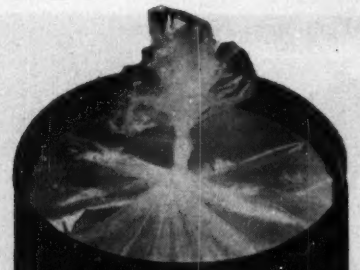
Once the fitting is assembled, the sleeve becomes permanently attached to the tube. Disassembly and reassembly of the fitting can be made without any loss of the sealing quality.

Ermeto fittings are available in carbon and stainless steel from stock, and in Monel and brass on special order.—*The Weatherhead Co., 300 East 131st St., Cleveland 8, Ohio.*

Wide World

PLASTIC PIPE MADE FOR HIGH PRESSURE SERVICE **(D)**

Kraloy D-500 rigid vinyl plastic pipe passes through cooling bath following extrusion. Furnished in ½ to 4 in. sizes this pipe will handle corrosive chemicals up to 190 deg. F. and 500 psi. A complete line of fittings includes threaded adapters for joining to steel pipe. Pipe is resistant to sunlight and weather.—Kraloy Plastic Pipe Co., 4710 East Washington Blvd., Los Angeles 22, Calif.



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- citric acid
- copper suphate
- diethylene glycol
- ferric chloride
- ferrous sulphate
- formaldehyde (40%)
- formic acid (100%)
- formic acid (up to 50%)
- glycerol (50%)
- lactic acid (10%)
- lactic acid (90%)
- magnesium chloride
- magnesium sulphate
- nickel sulphate
- phosphoric acid (30%)
- potassium borate
- potassium carbonate
- potassium chloride (sat. sol'n)
- potassium dichromate (40%)
- potassium hydroxide
- potassium nitrate

- potassium permanganate
- silicic acid
- silver nitrate
- sodium benzoate
- sodium bisulphite
- sodium carbonate (dil. sol'n)
- sodium carbonate (conc.)
- sodium chlorate (sat. sol'n)
- sodium chloride (sat. sol'n)
- sodium hydroxide
- sodium sulphate
- sodium sulphide
- stannous chloride (cold sat'd)
- stearic acid (100%)
- sulphuric acid (10%)
- tannic acid
- zinc chloride (cold sat'd)
- zinc sulphate (cold sat'd)

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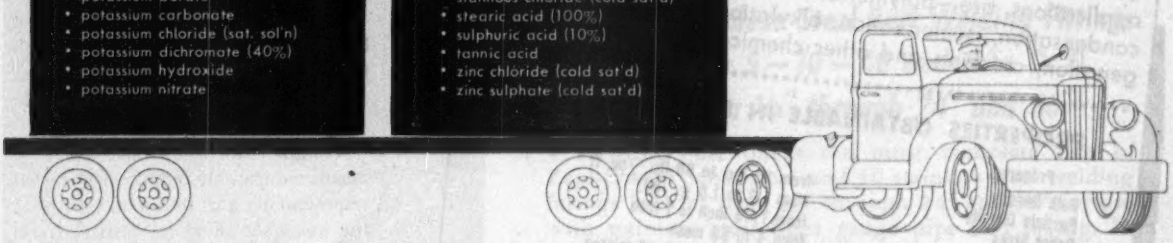
film liners cut tare weight costs up to 70%— assure 100% product recovery!



Example: VISQUEEN liner and "boot" in a fiber drum is 50% to 75% lighter than alternative containers—and safely carries 400 lbs. of liquids under all types of normal handling abuse. Accidental falls and bumps which might well shatter rigid containers leave VISQUEEN unaffected. This method of shipping is approved by the American Trucking Association.

Non-aging, non-toxic VISQUEEN polyethylene film is chemically inert. Doesn't dry out, get brittle, crack, shatter or split. Its tensile strength and uniformity are unduplicated by any other film on the market.

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IMPORTANT! VISQUEEN film is all polyethylene, but not all polyethylene is VISQUEEN. VISQUEEN is the only film produced by process of U. S. Patent No. 2461975. Only VISQUEEN has the benefit of research and technical experience of The Visking Corporation, pioneers in the development of pure polyethylene film.

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Bulk Density	from 25 lbs. to 80 lbs. /cu. ft.
Particle Density	from 1.0 to 1.8 g. /ml.
Pellet Sizes	from 1/16 inch to 1 inch
Granule Sizes	from 4 to 60 mesh
Powder Sizes	from 10% to 50% 0-20 micron
Surface Area	from 50 to 500 sq. meters per gram
Water Content	from 4% to 22%
Attrition Resistance	from medium to very high
Porosity	from 0.3 to 0.6 pore volume ml. /gm
Promoters Impregnation	from non-impregnated to highly impregnated
Activity	from specific high or low to non-specific high or low

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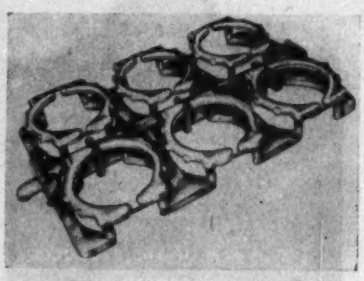
EQUIPMENT NEWS, cont. . .



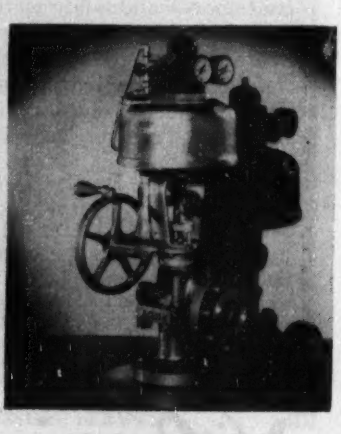
Dust Tube Blow Rings Now Self Adjusting **A**

Through use of a light weight aluminum casting a new blow ring carrier design provides self adjustment of the rings around the individual dust tubes. In addition, the entire blow ring assembly is mounted so that it floats laterally to accommodate variations in vertical alignment of the bags under all conditions. These features eliminate unnecessary chafing and wear in concentrated areas along the bag surfaces, it is said.

Each blow ring is made in two half sections. Each half section is mounted on the carrier frame by two flexible rubber tubes.

The carrier casting is made up of hollow sections bolted together. High pressure air is fed through the hollow casting and up the flexible tubes into each blow ring.

Weight reduction up to 50 percent means comparable reduction in power requirements and motor size to drive the assembly along its vertical travel path.—*Turner & Haws Engineering Co., Inc., 87 Gardner St., Boston, Mass.*

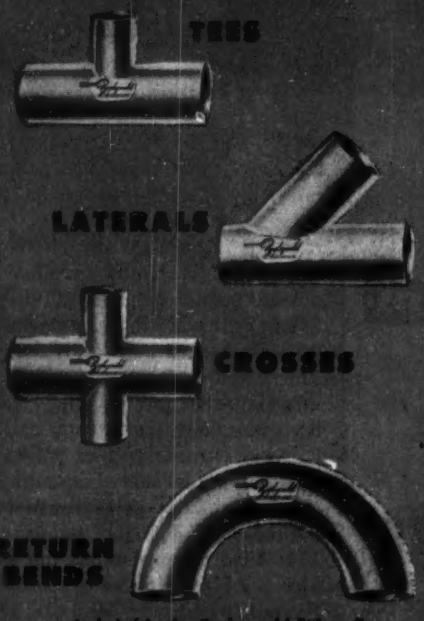


Automatic Control Valve Can be Operated Manually **B**

In response to demands from the field a new control valve combines both automatic and manual opera-

Zephyrweld®

WELDING FITTINGS for CHEMICAL PROCESS Service



. . . Included in the Zephyrweld fittings line are reducers and adapters to permit their use with practically every other butweld type of fitting.

QUALITY *Stainless Steel Butt Welding Fittings in Schedule 5 — 10 — 40 and tube O. D. Sizes from ½" through 24" and 36"*

• TRI-CLOVER offers the most complete line of Zephyrweld Schedule 5 and 10 stainless steel welding fittings in sizes from ½" through 24" and 36" for use with stainless steel light gauge pipe and tubing. In addition, Schedule 40 fittings are available in sizes through 24".

These quality fittings are annealed, pickled and passivated in sizes through 4". Larger sizes are passivated and may be annealed upon request.

Employing modern, unique and proved methods throughout, these porosity-free fittings are fabricated from stainless steel types 304, 347, 316 and other stainless steel analyses.

Schedule 5 and 10 fitting ends are cut flush for rapid welding. Because of their light gauge, no chamfering is required. Schedule 40 fittings are beveled in accordance with ASA specifications. Fittings can be flame cut for disassembly, used again by re-welding.

See your nearest distributor for full details.

WRITE FOR CATALOGS

Send for CATALOG 748, covering welding fittings for O.D. tubing—or for CATALOG 1051, covering Schedule 5-S and 10-S fittings for light gauge pipe.

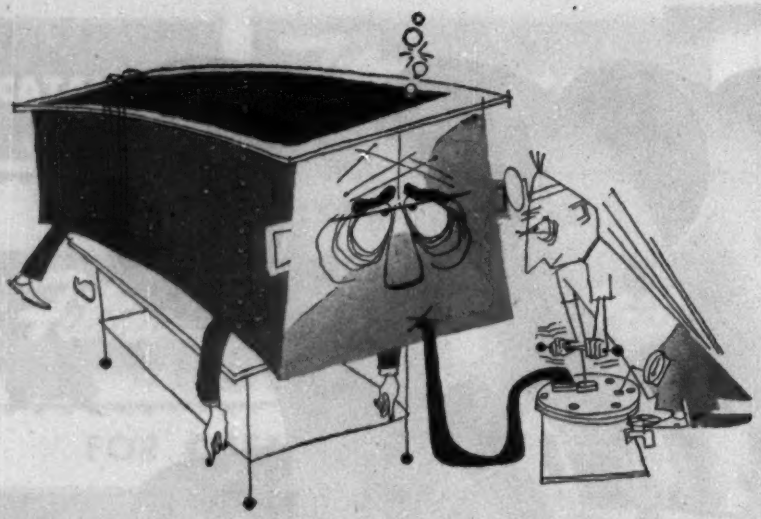
Tri-Clover® MACHINE CO.
Kenosha, Wisconsin

PI-152R

TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

THE Complete LINE

FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS



has **coil-itis** * cramped your production flow?

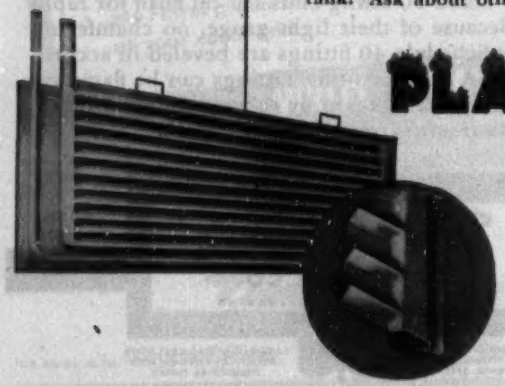
It's a waste of costly time to pump out the solution every time your process heating and cooling tanks get indigestion due to pipe coil troubles. You can save this cost and eliminate production bottlenecks by replacing the pipe coils with Platecoils. Platecoils can be removed and replaced **without dumping the solution.** They simplify maintenance and save hours of downtime. They heat or cool 50% faster and take 50% less space in the tank. As revolutionary as the new wonder drugs, Platecoils cure production troubles involving heat transfer . . . and give profits a shot in the arm.

Write for bulletin P61 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS TRIPLE PRODUCTION

At Continental Motors Corp., 3 crankcase sections can be cleaned at one time when Platecoils are used while only one crank case can be cleaned with pipecoils in the tank. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

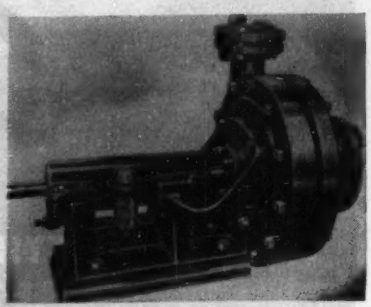
*

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, TRANTER MANUFACTURING, inc., LANSING 4, MICHIGAN

tions. This permits convenient and positive supplementary control during start up periods or when the system is shut down temporarily for instrument repair.

Models 1520 SMW and 1560 SMW are furnished with standard Domotor for automatic control and a side-mounted handwheel for manual control. Units are built to withstand operating pressures to 5,000 psi. with special applications to 50,000 psi. Effective operating temperature ranges from −100 deg. to 450 deg. F.—*Annin Co., 3500 Union Pacific Ave., Los Angeles 23, Calif.*



Centrifugal Pump Constructed of Plastic **A**

Fluid end parts of a new centrifugal pump are constructed of chemical and thermal shock resistant plastic material. The plastic composition contains a phenol-formaldehyde resin or furfuryl alcohol resin, and an inert filler of asbestos or graphite.

Pump is designed for mechanical seals which are easily installed and serviced because of the large drip pan. A long heavy bearing housing insures perfect alignment. Specially designed slinger and housing cap with triple internal seals protect the bearings from contamination.

Pump is made with 3 in. suction and 2 in. discharge. Operating at 1,750 rpm., the pump will handle capacities up to 300 gpm. and heads to 110. Liquid temperatures can be as high as 265 deg. F.—*Centrifugal Pump Div., Mission Mfg. Co., Houston, Texas.*

Tube and Pipe Fittings Absorbs Vibration **B**

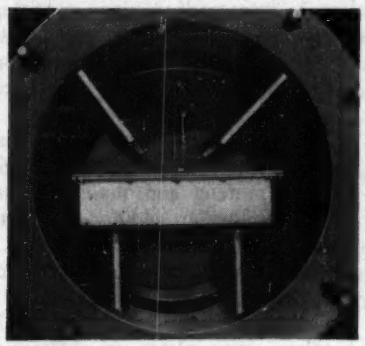
A unique shock absorbing and vibration fatigue-proof fitting for metal tubing and piping eliminates metal-to-metal contact. Originally developed for aircraft use, the Sealastic fitting

has now been adapted to general industrial use.

Fitting comprises a compression nut housing a synthetic rubber seal fixed to the tube by a metal ferrule. Sufficient tube clearance is provided in the connection and nut to ensure against metal contact between the tube and fitting. No flaring of tubing is necessary.

Tightening the nut places the entire seal under compression with the rubber ring acting as a cushion. Flexibility of the seal eliminates necessity of exact tubing alignment. Even if the tube is moved through an arc up to 5 deg., the fitting provides a strong union and leakproof seal.

Sealastic fittings will withstand pressures up to 4,000 psi. after finger tightening. When wrench tightened they will sustain pressure resistance beyond that of the tube itself. Temperatures ranging from −70 deg. F., to +400 deg. F. can be handled for special applications.—*Chicago Forging & Mfg. Co., 2000 Southport Ave., Chicago 14, Ill.*

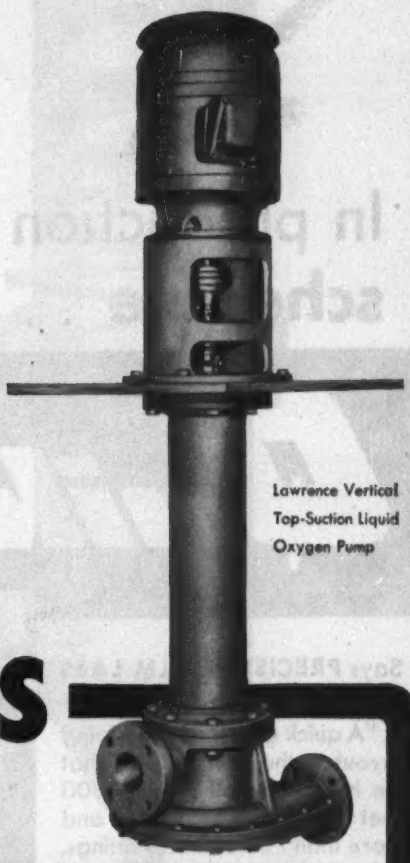


Magnet for Slurry Lines Collects Tramp Iron A

Developed originally for removal of tramp iron from paper stock, a new magnetic trap can be used wherever there is danger of metallic contamination inclusions. Unit must be installed in a section of vertical down pipe. This position takes advantage of gravity to drive material containing tramp iron directly onto the magnet face.

Unit consists of a cylindrical housing furnished by the customer with an inlet at top and an outlet at bottom. Baffles and magnet supports are included within the housing.

In operation material flows directly onto the middle of the magnet face plate dividing in two direction to flow off the sides of the plate into the outlet pipe. Depth of flow over the magnet is restricted by the baffles



Lawrence Vertical Top-Suction Liquid Oxygen Pump

PUMPS to handle LIQUID OXYGEN

At —297.4° F. — the boiling point of liquid oxygen — many abnormal factors must be considered in designing a centrifugal pump. Metals become brittle . . . packing will freeze solid . . . the net positive suction head is usually very low, so that the liquid is at or near its boiling point. All of these difficulties are successfully overcome in Lawrence Vertical Top-Suction liquid oxygen pumps.

Lawrence construction employs metals not affected by the extreme low temperature and locates the packing far enough above the liquid so that it is exposed only to the oxygen vapors and functions normally. Location of the suction on top prevents vapor binding, even at boiling point.

If your problem involves pumping a liquefied gas at extreme low temperature, write us the pertinent details. No obligation.

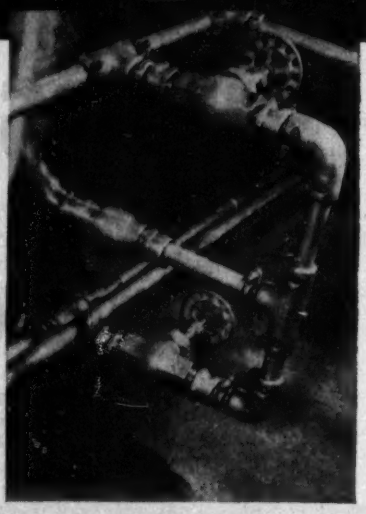
Write for Bulletin 203-6 for summary of acid and chemical pump data.

LAWRENCE PUMPS INC.

371 MARKET STREET, LAWRENCE, MASS.

In production **ahead of schedule** . . . thanks to

Quikupl



Says PRECISION FILM LABS
NEW YORK, N. Y.

"A quick glance at the piping layout in the print told us that we had to install about 1000 feet of stainless piping and more than 700 stainless fittings. Thinking in terms of conventional assembly methods, this meant three months of work before we could start operations."

"Just about this time, Quikupl became available. In addition to putting us in business eight weeks ahead of schedule, it sliced 40-50% off our estimated installation costs. And what's more, we now have a stainless processing line that we can tear down in a jiffy for clean-out or rearrangement."

"Cost conscious plant men will find Quikupl worth investigating."

BULLETIN Q100

Get the full story of this amazing stainless steel fitting which permits quick assembly and disassembly of stainless pipes or tubing without threading, flaring or welding.

Write for Bulletin Q100 today.

THE **COOPER ALLOY**
FOUNDRY CO. • HILLSIDE, NEW JERSEY

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POSITION _____

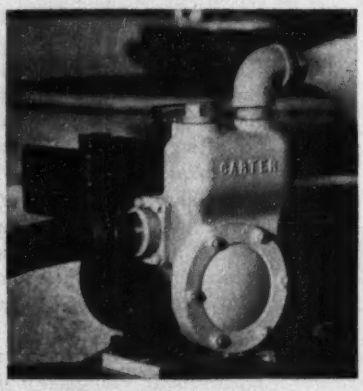
COMPANY _____

ADDRESS _____

CITY _____ STATE _____

to 3½ in. A pressure sealed door on the side can be easily opened in order to slide the magnet out for removal of collected tramp iron.

Traps are designed to cover a range of flow rates from 1,500 to 5,000 gpm.—*Eriez Mfg. Co., 7 East 12th St., Erie, Pa.*



Self-Priming Pump Has Simplified Design **A**

A new self-priming centrifugal pump is claimed to be the simplest unit of its type ever developed. Only components inside the volute case are the impeller and the seal.

It is said the highly efficient volute design makes possible greater capacity, faster priming and more trash-handling ability. In addition the unit is light and compact.

Adjustment for impeller wear can be made without dissembling or replacing a single interior part. No shims, wear plates or replacement parts of any kind are required.

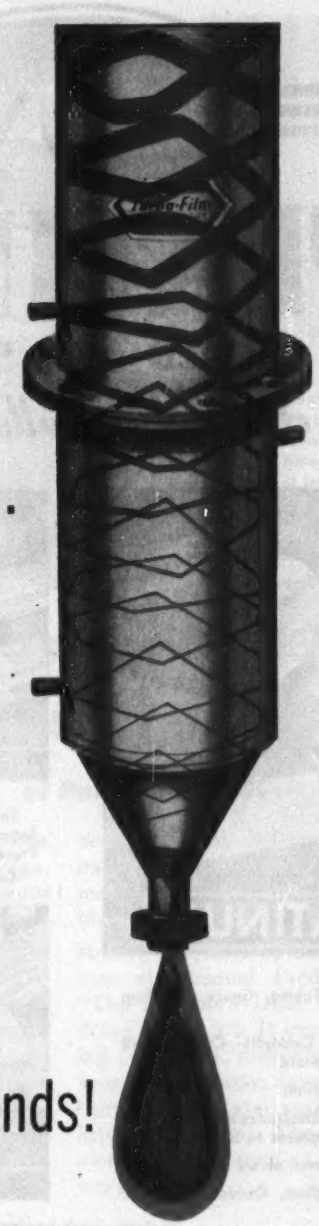
Sizes and capacities range from 1½ in. (5,500 gph.) to 10 in. (250,000 gph.). Units can be furnished for either direct or belt drives.—*Ralph B. Carter Co., 210 Atlantic St., Hackensack, N. J.*

Non-Woven Fabric Does Good Filtering Job **B**

Non-woven cotton or rayon fabric is finding a place in liquid filtration. An insoluble bonding agent gives the material high wet strength. Competitive in cost with paper filter medium, Viskon non-woven fabric can be used alone or as an auxiliary filtering membrane draped over expensive filter cloths to prolong their life.

High porosity with resultant high flow rate are claimed for this material.

(Continued)



The patented Turba-Film Evaporator (Luwa Process, Switzerland) processes liquids, slurries and gases . . . especially heat-sensitive or heavy viscous materials . . . by an advanced-

For hard-to-process chemicals...

design, thin-film principle of evaporation. It completely overcomes the disadvantages found in the ordinary falling thin-film systems. By creating *turbulence* in the thin film, localized overheating is prevented; foaming and frothing difficulties are overcome, and desired concentration is achieved in a single, few-second pass. And where only vapors are wanted, tests show distillation up to 99%!

The Turba-Film Evaporator retains color, potency, odor, nutritional and other valuable "original" properties.

continuous evaporation in seconds!

Maintains high "U" values . . . 100 to 500. No hydrostatic head. No vapor binding. The Turba-Film Evaporator is compact: easy to clean; easy to maintain; easy to change over from one product to another. You can prove its revolutionary advantages for yourself . . . in our plant or yours. Mail this coupon for full details.

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Type of Industry.....Product.....

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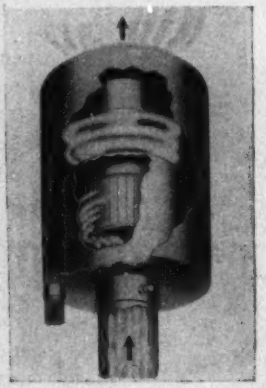
THE AMERICAN PLATINUM WORKS

PRECIOUS METALS SINCE 1875

231 NEW JERSEY R. R. AVE., NEWARK 5, N. J.

Long service life is obtained, particularly when filtering strong alkaline solutions and petroleum products.—*The Visking Corp., Dept. CA, Box 76, North Little Rock, Ark.*



Exhaust Vapor Trap Removes Entrained Particles A

A new exhaust head for industrial stacks removes entrained nuisance particles from vapor discharging to atmosphere. Troublesome oil, water, dirt and process liquor particles are thus kept off nearby equipment and buildings.

There are no moving parts or filters in the exhaust head. Troublesome maintenance and cleaning are thereby avoided.

Entrainment laden vapor entering the purifier is engaged by a stationary centrifugal element which imparts a carefully controlled yet rapid rotational movement to the vapor. Entrained particles are thereby thrown against the outer wall and fall or run down into the outlet drain. Clean dry steam or vapor continues upward discharging to the atmosphere.

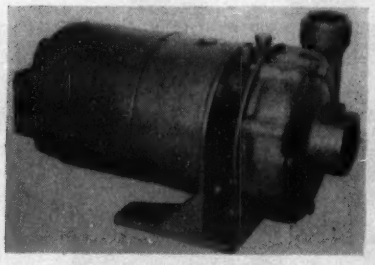
Guaranteed 99 percent effective the unit has fabricated steel body and stainless steel centrifugal element. Standard models have slip-on or flange connection for the stack and a threaded connection for the drain.—*V. D. Anderson Co., 1935 West 96th St., Cleveland 2, Ohio.*

Diaphragm Valve Is Pilot Operated B

Valve control of highly corrosive liquids, gases, slurries and food products is the function of a new pilot-operated valve with Saunder's patent valve body. It is said absolutely tight shut-off is provided.

Valve construction is simple; there are only two moving parts, the flexible diaphragm and the solenoid core. Either air or liquid pressure introduced directly from the pilot is impressed upon the diaphragm to close the valve. When imposed pressure is released line pressure opens the valve.

Valve bodies are cast iron, bronze or stainless steel. Special sanitary constructions are available for food applications. Pipe sizes range from ¼ to 2 in. Watertight or explosion-proof enclosures can be supplied for the operating mechanism. — *Automatic Switch Co., 379-C Lakeside Ave., Orange, N. J.*



Close-Coupled Pump Installs Easily **A**

Motor and pump are combined in one close-coupled mounting on the new Fig. 3642 centrifugal pumping unit. Pumping range is 110 gpm. max. at heads up to 110 ft.

Mechanical shaft seals are used and the discharge nozzle can be turned to any one of eight positions. Discharge outlets are tapped to accommodate 1 or 1¼ in. pipe.—*Goulds Pumps, Inc., Dept. C. E., Seneca Falls, N. Y.*

Slurry Pump Handles Abrasive Solids **B**

A new line of slurry pumps handles fine abrasive slurries over a wide range of head conditions. Especially designed impeller volutes are said to give improved flow and reduced wear. Abrasion resistant Gasite alloy is used in the construction. Design favors simplicity of maintenance. Pump sizes vary from 2 to 14 in.—*Georgia Iron Works, Augusta, Ga.*

Change of address:

Looking for Product News?

See page 328

Every shift, a roomful of waste dust is gathered by the Pangborn Dust Collector shown above, compressed into 5 bales of 450 lbs. each (like one at left), and sold.

Pangborn Dust Control traps over 2000 lbs. of dust a day

at Personal Products Corp.

Processing tissue and cotton items at Personal Products Corp., Chicago, Ill., frees great quantities of fibrous dust. To control this dust, a Pangborn Dust Control system at Personal Products filters 35,000 cu. ft. of air a minute.

Every shift, Pangborn equipment collects over 2000 pounds of dust which Personal Products bales and sells to paper mills and similar industries. During the winter, the already-warmed, cleaned air is reused, cutting fuel costs and eliminating need for additional heating equipment. And the dust-free atmosphere maintains working conditions at a high level.

Robert MontBlanc, Salvage Foreman at Personal Products, says: "The Pangborn Dust Collector is doing a good job. It improves working conditions, makes plant housekeeping less costly, saves money on heating costs, and gathers salable salvage material. The last factor alone makes Pangborn very much worth-while."

Look to Pangborn for the latest developments in Dust Control and Blast Cleaning equipment

Pangborn DUST CONTROL

STOPS THE DUST HOG from stealing profits

WHAT IS YOUR DUST PROBLEM?

Whatever aspect of dust control bothers you, Pangborn will solve your problem. Mail coupon today for complete information.

PANGBORN CORPORATION,
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Gentlemen: Please send me a copy of Bulletin 909A.

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DARCO Digest

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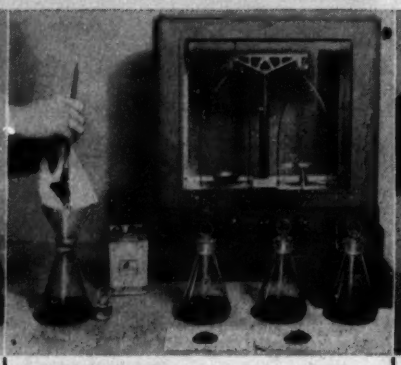
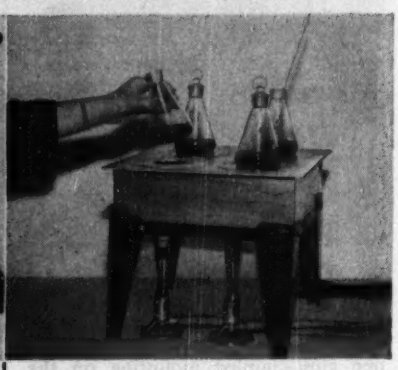
ATLAS POWDER COMPANY, CANADA, LTD. BRANTFORD, CANADA

SIMPLE TESTS IN YOUR LAB DETERMINE DOSAGE OF DARCO ACTIVATED CARBON

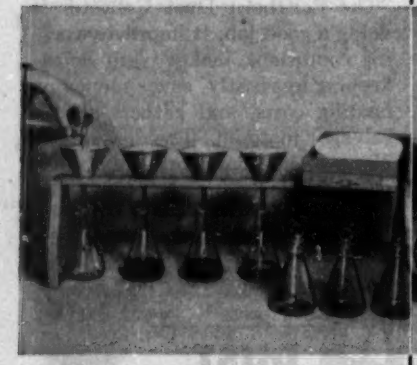
1 Measure or weigh out four 100-gram or 100-ml. samples of the liquid to be purified. Test sequence shown is for decolorizing; similar technique is used for other types of purification.



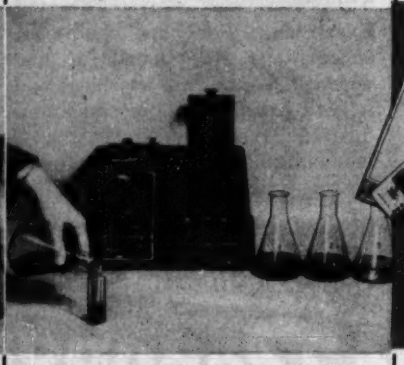
2 Add 0.5, 1.0, and 1.5 grams of Darco activated carbon to portions 1, 2 and 3 respectively. Portion 4 is your untreated control sample.



3 Agitate all samples by hand for about one-half hour, while heating on a steam bath to a safe temperature for your particular liquid.



4 Remove carbon by filtration—but collect sample only after filtrate becomes clear. You may need suction filtration for viscous liquids.

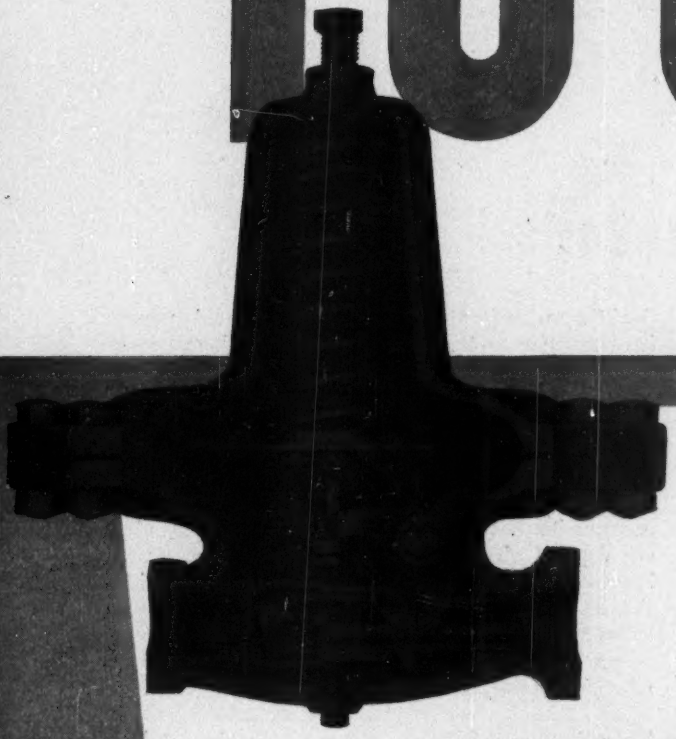


5 Determine residual color of filtrates and color of untreated sample by means of a suitable colorimeter.

6 By means of a Darcograph, plot the relation between color adsorption and carbon dosage . . . and read off the dosage for the residual color you require.

You can make these tests easily in your own laboratory, using equipment which you have on hand. By varying dosage ranges, temperatures, contact time, you can readily arrive at optimum treatment conditions. . . . We'll be glad to send you a Darcograph, instructions on its use, and samples of Darco for your testing. If you will outline your problem to us, we can suggest the most probable grades of Darco for your use, and thus save you testing grades we know, from experience, to be unsuited for your needs.

* TYPE 1000 VALVE



Any product of quality should be dependable when *ordinary* products fail. Sudden pressure fluctuations, dirt, scale and viscous matter prove "fatal" to ordinary pressure reducing valves.

The CASH STANDARD TYPE 1000 VALVE however, is designed to operate with complete dependability under the most difficult and unusual circumstances. Many of these units have been in service over 10 years and have never been taken "out of the line."

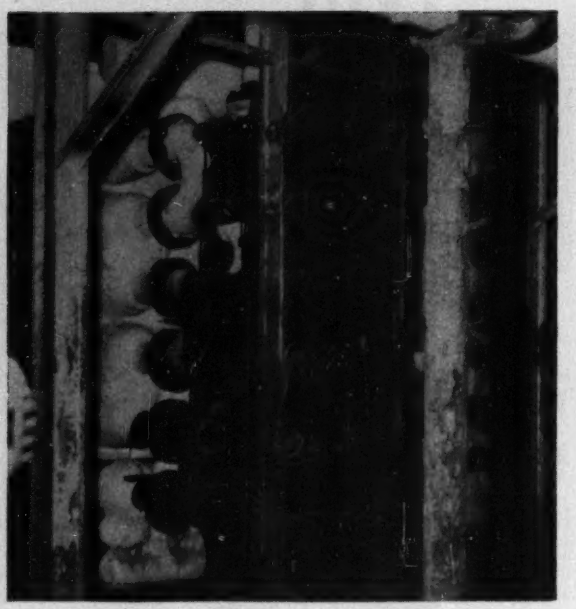
Truly an *EXTRAORDINARY* achievement of quality and design excellence.

*** INSTALL CASH STANDARD "TYPE 1000" VALVES**

CASH STANDARD **DECATUR, ILLINOIS**

A. W. CASH COMPANY

1 Storage tank, drying plant, and part of chilling plant (right) are shown in this general view of the plant.



2 Drive end of a chiller showing uninsulated ammonia lines and connections. Chillers proper are insulated.

Anhydrous Sodium Sulfate

A CHEMICAL ENGINEERING PICTURED FLOWSHEET

Chilling and submerged combustion figure prominently in this process for the production of anhydrous sodium sulfate from natural brines.

At the Monahans, Tex., plant of the Ozark-Mahoning Co., anhydrous sodium sulfate is recovered from a natural brine pumped from a shallow deposit which is spread over an area of some 2,500 acres. An abundant supply of brine containing 7 percent to 8 percent sodium sulfate is found at a depth of about 60 ft. and is utilized together with a limited supply of stronger brine found at a depth of about 90 ft. containing about 11 percent sodium sulfate.

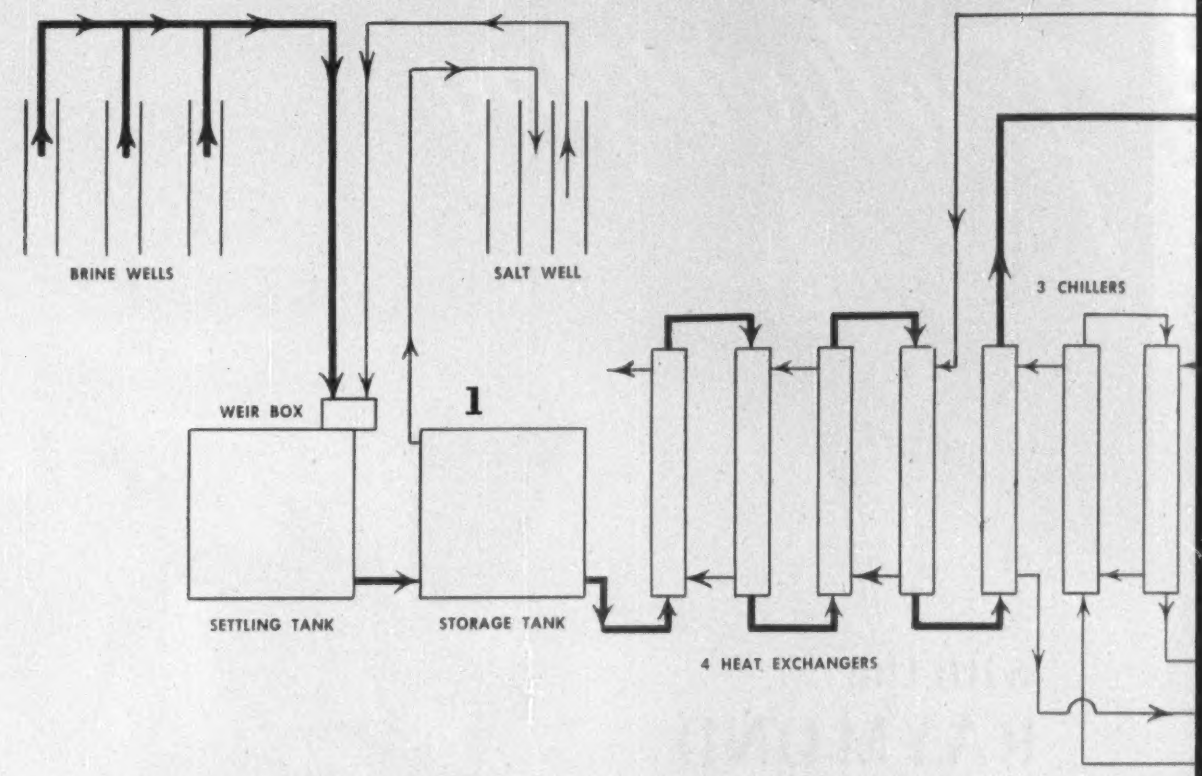
Other constituents of the brine are sodium chloride and magnesium sulfate. The sodium sulfate is recovered by chilling the brine to about 15 to 20 deg. F. to crystallize out Glauber's salt ($Na_2SO_4 \cdot 10H_2O$). Prior to chilling, the brine is pumped into a salt deposit where it becomes saturated with sodium chloride which serves to decrease the solubility of the Glauber's salt and increase the recovery.

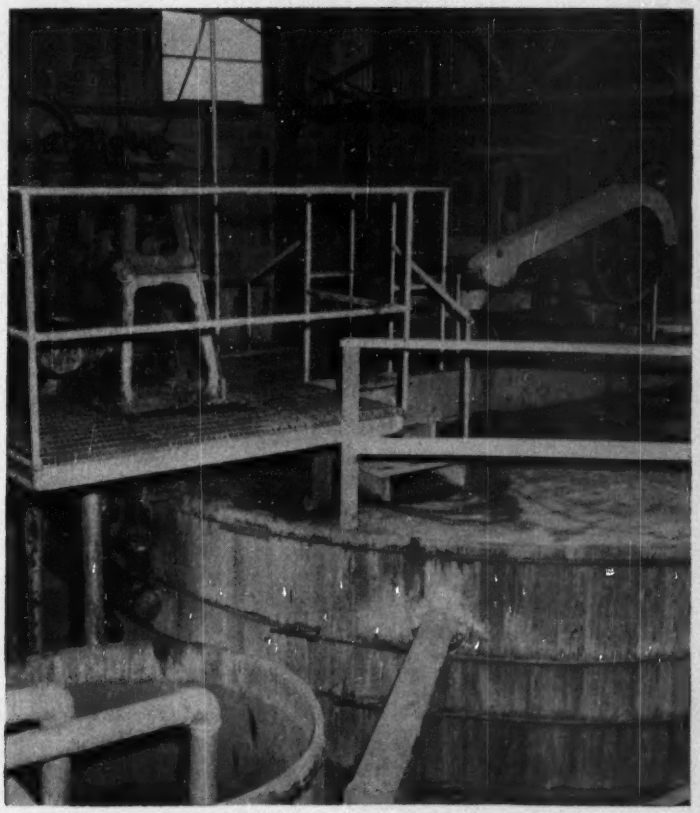
The Glauber's salt is melted and the water of crystallization is removed in gas burning submerged combustion evaporators. The wet salt removed from the evaporators is dried in a rotary kiln to produce the anhydrous material.

It would be impractical to dehydrate the brine directly because, aside from the considerable fuel cost for evaporation, the magnesium sulfate and sodium chloride present in substantial quantities and would cause formation of a mixed salt. Glauber's salt has a very steep solubility curve. Hence, an excellent selective crystallization can be made by the cooling process, the other salts remaining in solution.

After 17 years of operation, the main consideration in operation of the deposit is to conserve the limited supply of strong brine. In 1948 the chilling capacity of the plant was doubled which makes it possible to use more weak brine and maintain the same rate of production. Exploration and development work also is being carried out on brines in Eddy County, N. M. As part of the development program these brines are being trucked to the Monahans plant and incorporated into the plant feed. The New Mexico brine is very rich in magnesium sulfate. By combining it with weak brine or fresh water which has been saturated with sodium chloride, the plant feed can be maintained at the same concentration as when utilizing the strong brine alone.

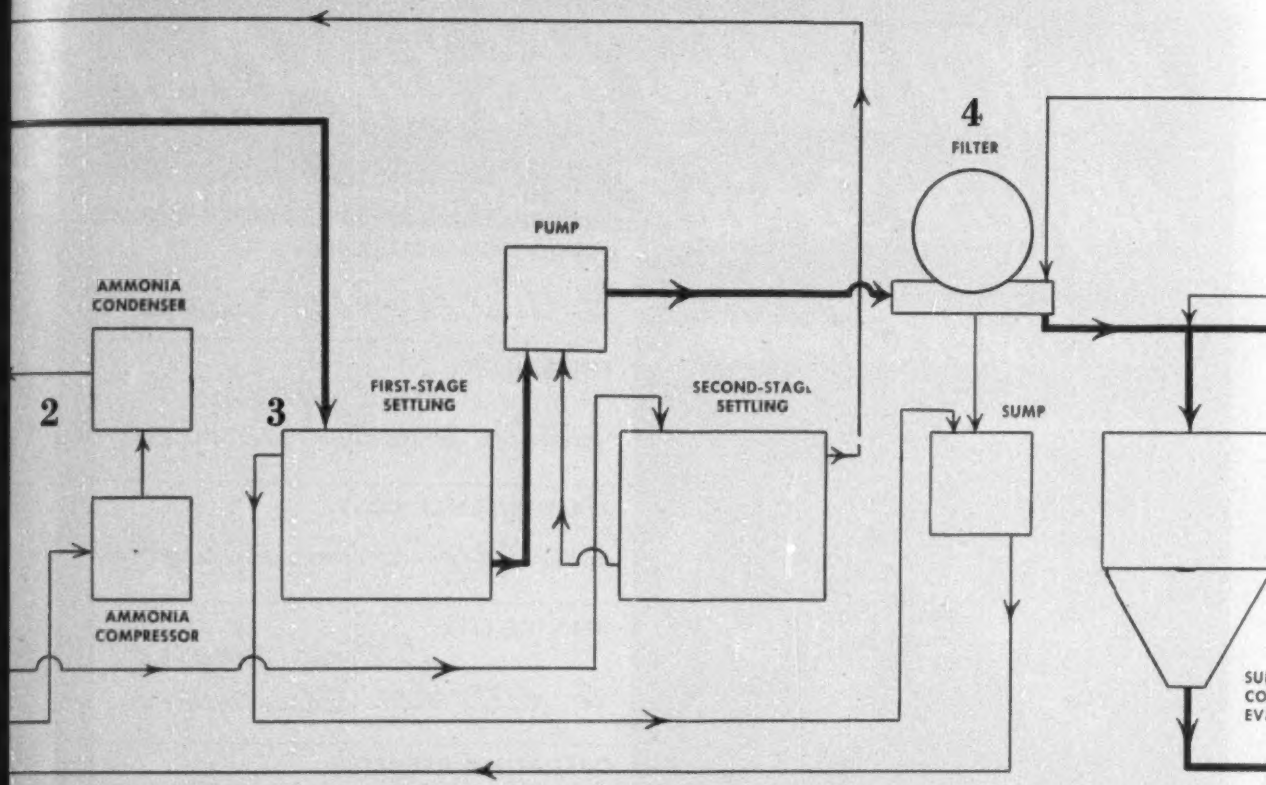
Another recent development at the Monahans plant has been on the use of oil fuel for the submerged combustion evaporators. Plant tests have been made with special oil vaporizing equipment which demonstrated that high grade fuel oils can be utilized in submerged combustion burners. Natural gas is readily available in the Monahans area, but this development may be of significance for the exploitation of sodium sulfate brines in other areas.



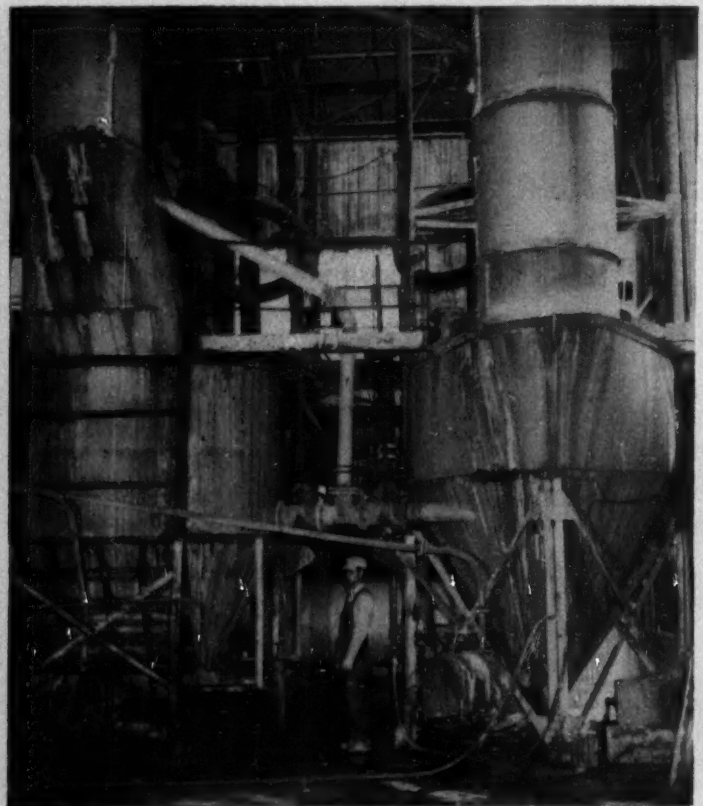


3 One of the thickeners in the chilling plant where crystals of Glauber's salt settle out from the liquor.

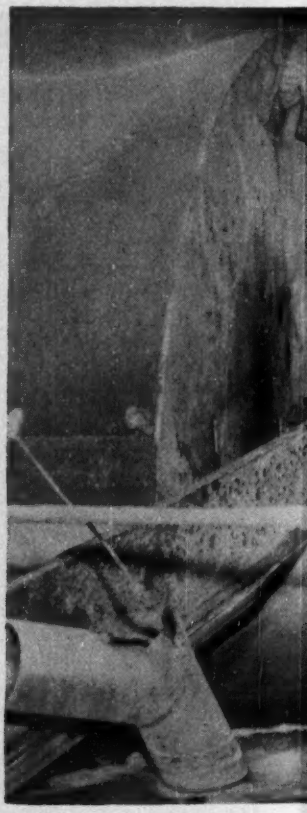
4 Rotary vacuum filter which removes water from th crystals of Glauber's salt.



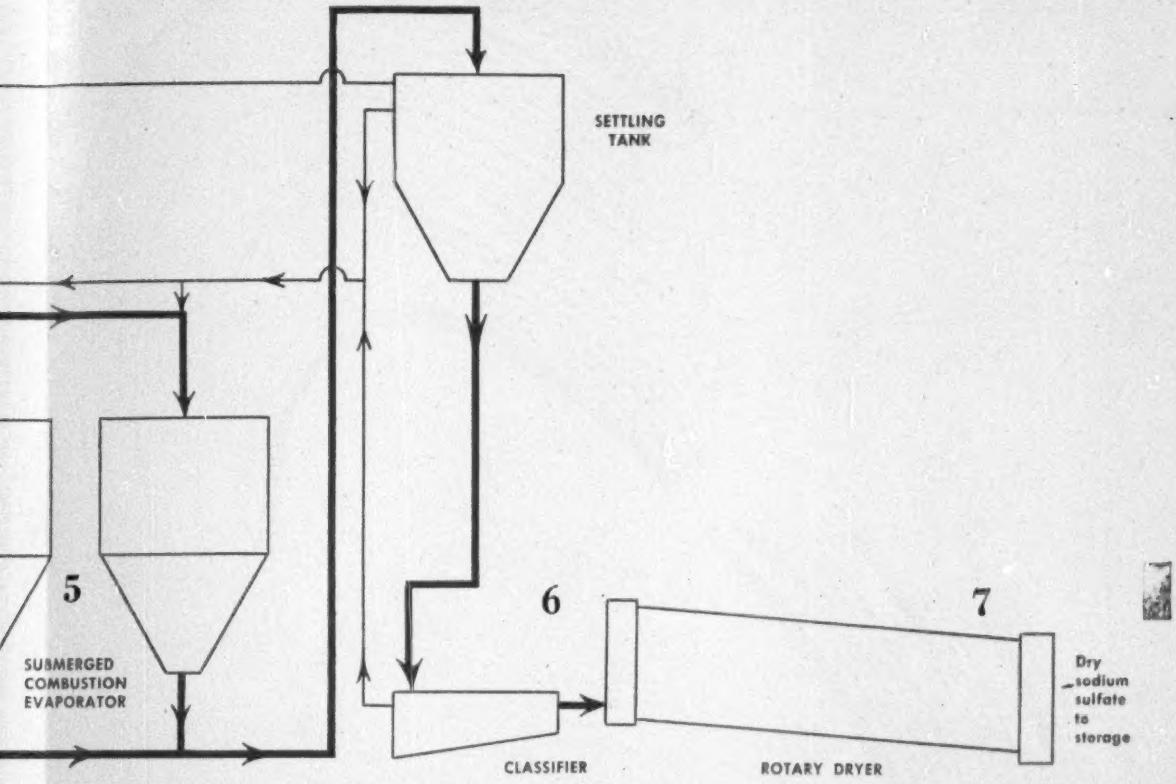
ckened slurry containing

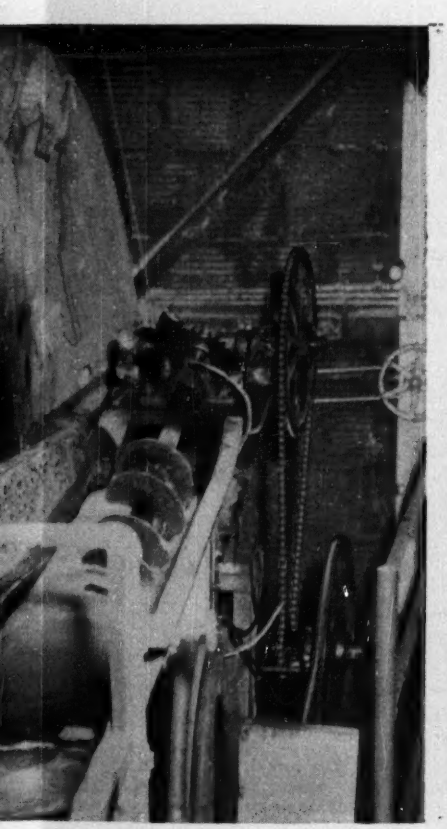


5 Gas-burning submerged combustion evaporators melt the Glauber's salt and drive off water of crystallization.

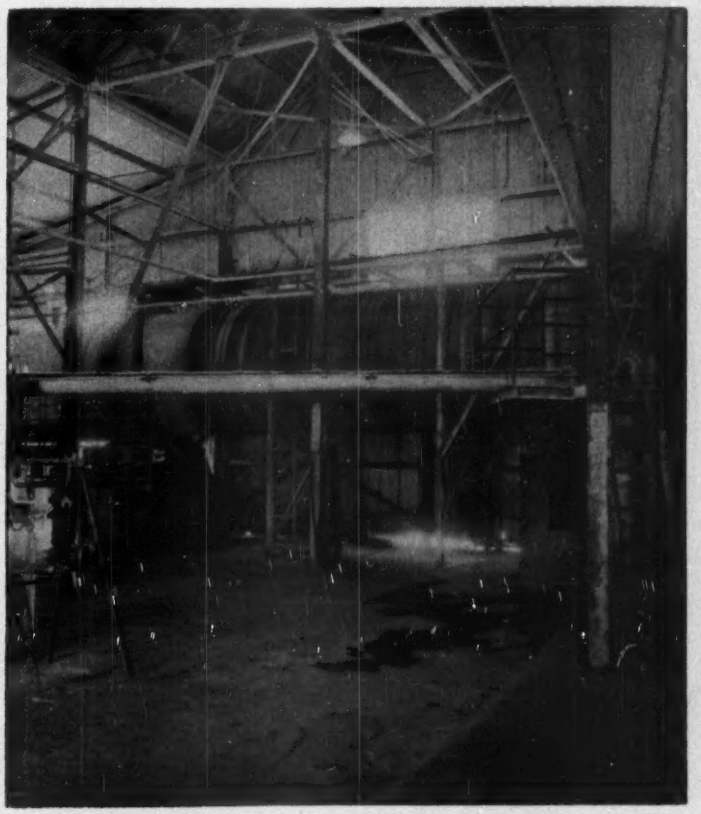


6 Screw-type thickener which fe to the rotary dryer.

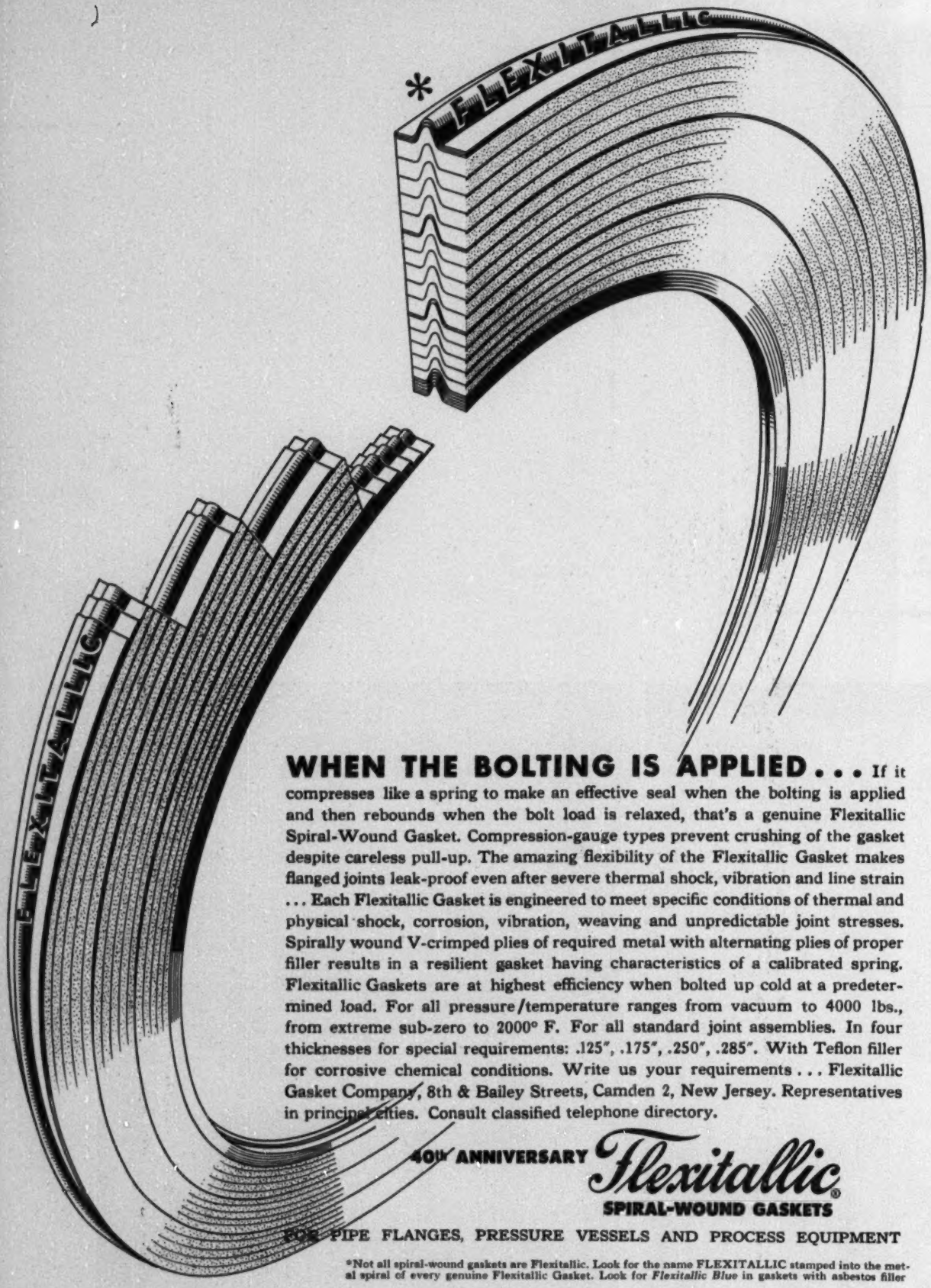




ich feeds wet crystals of anhydrous sodium sulfate



7 Direct gas-fired rotary dryer removes water from crystals of wet anhydrous sodium sulfate from the submerged combustion evaporators.



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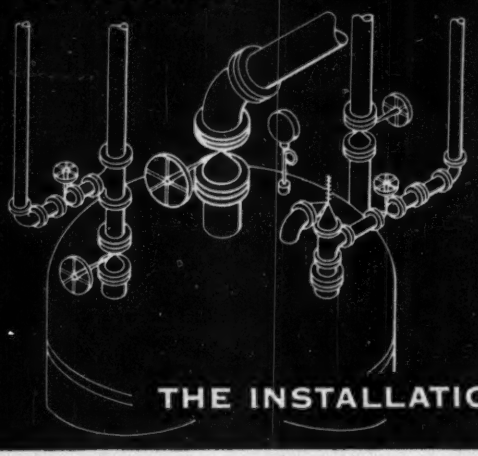

THE INSTALLATION

Crane Ni-Resist valves on starch inlet lines to converters, Corn Products Refining Co. plant, Argo, Ill.

VALVE SERVICE RATINGS

CORROSION-RESISTANCE:	Ni-Resist OK–18-8 Mo trim ideal
SUITABILITY:	Good for this mildly corrosive service
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OPERATING RESULTS:	Much less process interruption
PRICE:	In line
AVAILABILITY:	Regular Crane Catalog item

THE HISTORY

Valves in this service are constantly exposed to hydrochloric acid vapors under working pressure of 50 psi at approximately 280 deg. F. None of the valves formerly used lasted more than 2 to 3 weeks without repairs. In 3 to 4 months they had to be retired from service for rebuilding. Maintenance costs were excessively high.

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YOU AND YOUR JOB

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17% Chromium stainless steels **260**

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Think you're cut out to be a technical editor?

Here's your chance to take a squint at that "new industry phenomenon"—what he does, the pay he gets (*You & Your Job*).

More data on stainless steel.

This month we give data on the 17 percent chromium steels and how they resist chemical corrosives (*Corrosion Forum*).

Watch Germany's comeback!

German producers are already causing upheavals in the world chemical markets. Here's why there'll be more *(Economics)*.

New way to octyl alcohols.

That's just one of the unusual ideas in this month's new process and equipment patents (*Tomorrow's Technology*).

AND—Index of Advertisers precedes your Reader Service section inside the back cover.

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. . . A New Industry Phenomenon

JOHN A. WALTER and GORDON MILLS

The letter was addressed to the Department of English of the University of Texas. It came from one of the better-known chemical companies.

"Dear Sir," it began . . .

"We have several attractive openings in our company for technical writers and editors. The men to fill these positions ought to have special training or other qualifications in writting and editing as well as a good technical background. The primary duties of these men will be to rewrite engineering reports into clear, concise, accurate and readable English . . ."

This letter was typical of quite a number that have been received by the University of Texas and similar educational institutions.

Employers are looking for technical writers—one of the newest professional groups in the country. Because the art is brand new nobody knows what it's all about. Employers have a vague idea that reports ought to follow a standard form, use correct English and admit of some semblance of logic. So they hire writers. These writers have to comprehend technical material, appreciating accuracy and nuances down to the fourth decimal place, so they call them "technical" writers. But they're not sure what kind of education and training such men should have—or what they're worth on the payroll. And so it goes.

To dispel some of this confusion, we decided to make a survey of technical editing in industry to find out:

1. How much technical editing is done and who does it—employees hired for the purpose—or supervisors and executives on a part-time or "extra" duty basis?
2. What kind of editing is done?
3. What are the education-and-experience requirements of technical editors?
4. How much are these men paid?
5. What is the attitude of employers on the importance of advanced training in technical writing and editing for technical employees?

To get this information, we sent questionnaires to 200 industrial firms in the U. S. We received replies from 151, or 75 percent of the total and, of these, 141 were usable.

Here are the results:

HOW MUCH TECHNICAL EDITING?

To the question: "Do you employ anyone whose full or part-time duty is to act as editor of the writing of technical reports in your organization?" we received the following replies:

Full-time	Part-time	None
27 (19%)	38 (27%)	76 (54%)

Thus a total of 65, or 46 percent of the 141 companies employ someone

JOHN A. WALTER *is Chairman, Committee on Technical Writing Courses at the University of Texas.* GORDON MILLS *is Assistant Professor of English at the University. A book on technical writing, under their joint by-line, will be published soon.*

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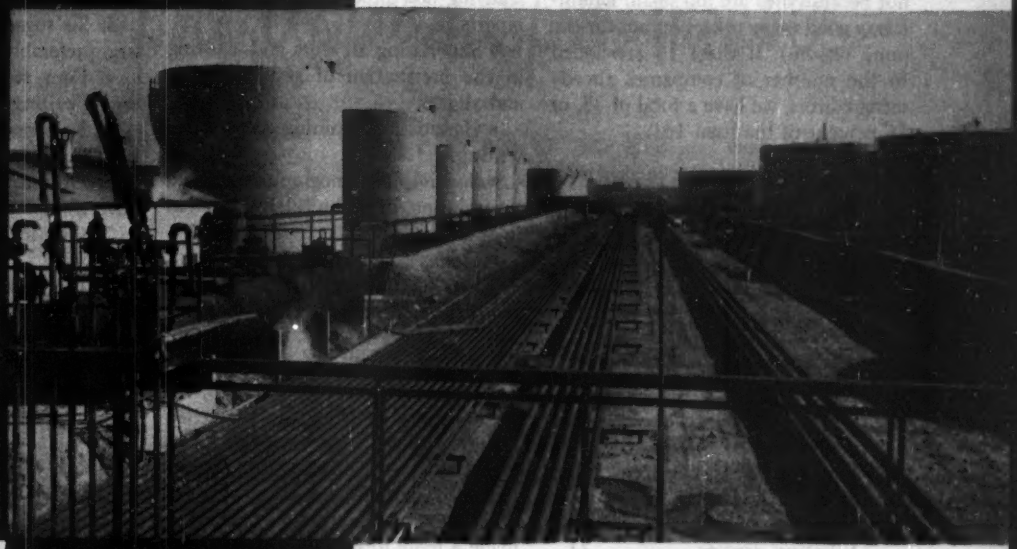

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either full or part time in a formal editorial capacity.

Along with this question, we also asked those not employing editors whether anyone in their organization was charged with checking the form and clarity of reports. A total of 46, or 33 percent, replied that someone did perform such checking, usually a department head or section chief.

In addition to these questions about formal or supervisory editing, we inquired whether written instructions were issued to those who write reports. Sixty percent replied that they did issue formal written instructions to report writers. This number included both those companies employing editors and those that do not. Of those not employing editors, 54 percent do issue written instructions on report form and layout, and 50 percent require a standard pattern or organization for reports.

We also found that 13 of those companies not now employing an editor plan to do so in the future. (An additional four of those not using editors specifically stated that they did not because they are too small. Doubtless, a good many others do not for the same reason.) If these 13 are added to the number of companies already using editors, we have a total of 78, or 55 percent of the total 141.

WHAT DUTIES DOES EDITING INCLUDE?

Editorial Duties	Percent
1. Putting reports into standard form	71
2. Checking conformity of reports to specified pattern of organization	77
3. Checking accuracy of usage	88
4. Rewriting to improve readability	82
5. Writing reports from technical data supplied	64
6. Classifying, filing, and distributing reports	34
7. Maintaining a reference library	26
8. Abstracting reports and articles	38
9. Handling report reproduction	45
10. Other duties	42

In determining what duties may be expected of an editor we asked that those replying check pertinent items of a selected list of duties. Above is a table showing what percentage of the 65 companies checked each item. Although some of the companies not using editors volunteered opinions as to duties editors should perform, we have excluded their replies as not having the interest or significance of those from the companies where editors are used.

It is not surprising, of course, that a large percentage of companies require their editors to check the correctness of English usage, and it is particularly interesting, and significant, that so many require their editors to rewrite for clarity and to write reports from technical data. The work done in connection with items 6 through 9 is often of a supervisory nature, we judge from accompanying comment.

The "Other Duties" list is surprisingly long. It includes the following:

- Writing speeches, movie scripts, brochures, technical papers, articles for trade publications, instruction manuals, and "consumer correspondence."
- Advising technical men in the planning and writing of reports.
- Designing forms and binders, and studying new production methods for reports.
- Supervising art work and assisting in the preparation of graphs, figures and slides.
- Conducting training courses in writing.
- Supervising stenographic staff and "integration of technical information in the files."
- Doing library research.
- Serving as patent coordinator for research department.

WHAT BACKGROUND FOR AN EDITOR?

It is easy to see from the foregoing section what professional talents the technical editor may need—to do his job ideally. But what about his educational background and his experience? One hundred and fifteen companies made a reply to our question: "What kind of general education do you think a technical editor should have—broad and diversified or specialized?" This question proved, apparently, to be somewhat ambiguous, for the phrase "broad and diversified" was variously interpreted. The replies, roughly classified, fall into three groups:

- Broad training (44 approved simply a broad and diversified education; 25 suggested broad and diversified training in science and engineering; 2 suggested broad arts and sciences training).
- Specialized (26 preferred specialized training in science and technology, usually in the field in which the company works, plus special training in journalism and composition or both).
- Both (17 recommended a combination of broad and specialized training).

Many in each of these categories stipulated that besides the training, an editor should have a flair for writing, or a predilection for it. An opinion widely held is that you can make a writer out of an engineer or scientist more easily than you can make an engineer or scientist out of a writer.

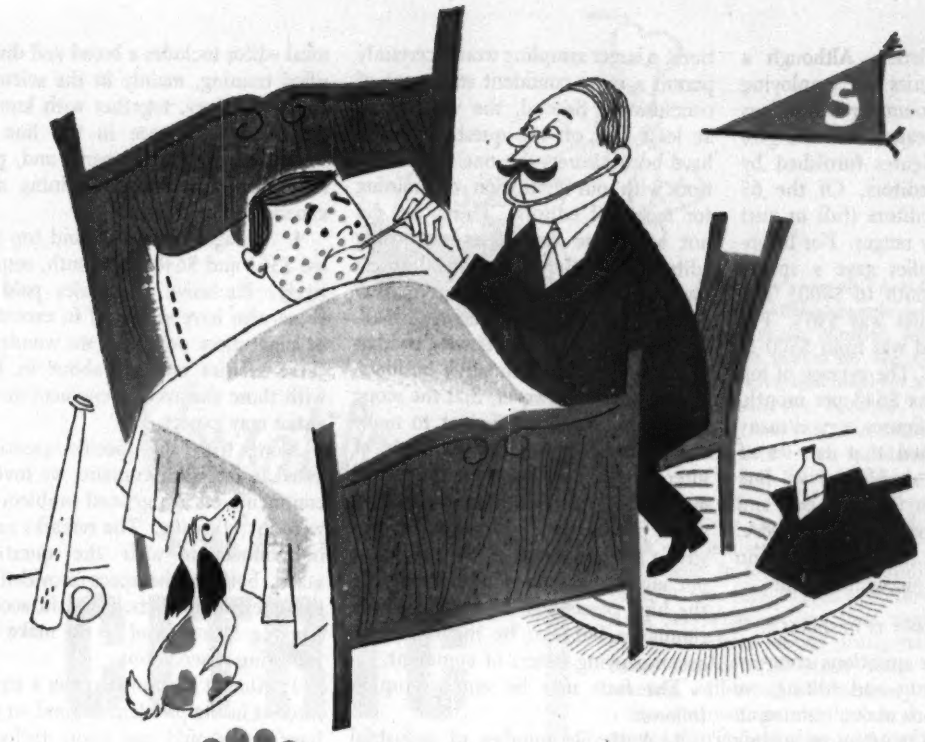
As for experience, 45 of the 65 organizations using editors furnished replies; the others apparently had no opinion—at least they offered none. The opinions may be grouped as follows:

1. Fifteen believe laboratory, shop, or field experience in the company's field would be helpful.
2. Nine believe that previous editing and writing experience is needed.
3. Six suggest experience in journalism, preferably in the trade press field.
4. Four recommend experience in report writing.
5. Five specify a need for familiarity with the company's work or product.
6. One feels previous experience in advertising would help.
7. One merely suggests "varied experience."
8. Four state that no specific experience is needed—just aptitude.

Besides suitable training and experience, a number believe that personal qualities may go a long way toward determining a man's competence for a job as a technical editor. Most of the qualities mentioned boil down to tact and pleasing personality. One person remarked that scientists and engineers may need to be dealt with diplomatically when their shortcomings in writing are pointed out to them and that the editor will need to know how to get along with these people in such a way as to make them see their weaknesses as writers, get their approval of changes, and encourage them in the direction of self-improvement.

WHAT ARE TECHNICAL EDITORS PAID?

In inquiring about pay, we were interested in finding typical beginning



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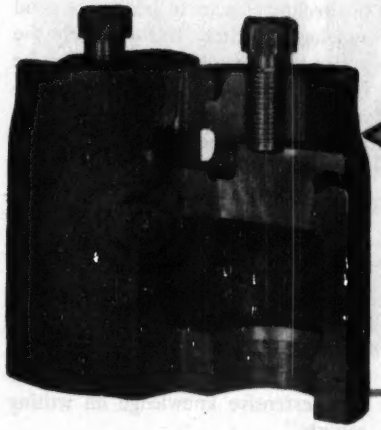

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and maximum salaries. Although a good many companies not employing technical editors volunteered opinions on suitable pay scales, we will give here only those figures furnished by companies using editors. Of the 65 companies using editors (full or part time), 37 cited pay ranges. For beginning pay, the replies gave a spread from $250 per month to $500. The average of all replies was $363. For top pay, the spread was from $500 to $1,000 per month. The average of top pay suggestions was $648 per month.

Without citing figures, a good many companies suggested that salaries of technical editors should be in line with those paid to the engineers and scientists with whom they would work. A few suggested that there was no upper limit for a successful editor.

HOW MUCH TRAINING IS DESIRABLE?

Along with our questions concerning technical editors and editing, we asked two questions about training in report writing and in advanced writing and editing for scientists and engineers. These questions were:

- In hiring technical staff members, does your rating of applicants include consideration of their training in report writing?
- Would you consider it desirable for your technically trained employees to have training in advanced technical writing and editing in addition to elementary training in report writing?

Of the 135 who replied to the first question, 66, or 49 percent said they did take writing into account. Some reported that they do not take such training into account because of the present scarcity of engineers or because they have no way of evaluating such training. We suspect that these reasons apply to a good many more who made no statement. As for advanced training in technical writing and editing for all technical employees, 95, or 70 percent, consider it desirable. Only 21, or 15 percent, replied that they did not consider it desirable; 20 replied that they "don't know" about its desirability.

CONCLUSIONS

Before stating any conclusions based on the results of our study, some statement about the limitations of our investigation is in order. First, as stated in the introduction, our questionnaire was sent to 200 industrial organizations; a larger sampling would certainly permit a more confident statement of conclusions. Second, the wording of at least one of our questions could have been clearer—the one in connection with our discussion of training for technical editors. Third, we did not ask those companies not using editors why they do not—although some of them volunteered information to the effect that they were too small, or that few if any reports were written in conducting the company's business.

We believe, however, that the scope of our inquiry was sufficient to make our data significant, and certainly of interest. Quite aside from the actual number of companies canvassed, we were particularly impressed by the strong interest shown in the subject of our inquiry, as evidenced not only by the high percentage of returned questionnaires but also by the numerous accompanying letters of comment.

The facts may be summed up as follows:

1. A sizable number of industrial organizations (88 percent of those we canvassed) feel a need for better written reports than they get from their technically trained employees and have attempted to remedy the situation (or plan to remedy it) through the use of editors, or through some form of supervision. Including the 9 percent planning to hire editors, a total of 55 percent believes that professional editors are the answer to their problem. At the same time, most companies would like to see technical men better trained in technical writing and editing. It is clear that editors are used simply because technical men have not been adequately trained for their writing tasks. In general, it is agreed that it would be desirable to have the technical staff well enough trained in writing so that assistance from an editor would be unnecessary. There are, of course, other duties for which an editor might be needed, as shown by the list of secondary editorial duties (on page 252).

2. The principal tasks performed by technical editors are rewriting to increase clarity, checking the form and organization of reports, writing reports and articles from supplied data, and checking the correctness of English usage. Minor tasks include a wide range of activities.

3. The background of education and experience most desired in a technical editor includes a broad and diversified training, mainly in the sciences and technology, together with knowledge and experience in the line of work done by the company, and, perhaps, some journalistic training and experience.

4. Averages of starting and top pay are $363 and $648 per month, respectively. Exclusive of salaries paid to those who have advanced to executive or supervisory positions, we wonder if these salaries are not about in line with those the average engineer or scientist may expect.

Along with the specific questions asked in our questionnaire, we invited comments on the general problem we were investigating. The remarks made in connection with the questions asked, both in the space provided on the questionnaire itself and in accompanying letters, lead us to make the following observations:

1. Almost all firms express a strong interest in the problem of good, or perhaps we should say poor, technical writing. Many, indeed, are quite vehemently concerned about it. One company writes, "Your recent request for information strikes a subject close to our hearts. Here . . . our need for technical writers is constantly increasing and our search never-ending." Another correspondent writes, "I feel so strongly on the subject that for years I have stated that the best course in chemistry that any chemist or engineer may take is more English." Still another says, "You are concerned with a problem of fundamental importance. We do not believe the answer lies in a technical editor so much as in training the technical man to become a good and logical writer. Unfortunately the better the research worker, the less he is interested in spending time in writing reports. If he can be made to understand just one point, a real contribution will have been made. That point is that when the technical man has completed a given project the only sure and permanent value the employer has received is the content of the technical report covering the project." Finally, another says ". . . our chief comment should be that we believe engineers in general need to have extensive knowledge on writing reports."

2. There appears to be some correlation between the size of a company and the use of editors—the big-

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ger companies are more likely to use them.

3. A few organizations completely reject the idea of editorial supervision and argue that for them the only possible solution to the problem of poor technical writing is better training for technical men. One advises, "Teach them to write English and the rest comes naturally."

4. A few others accept the need for technical editors but do so grudgingly and condescend to them, suggesting that "partially trained engineers," "thwarted pre-med students," and "men without originality" are good candidates for such work.

In addition to our personal experience, the facts we have secured through this survey prompt us to make several general observations about the situation as a whole. First of all, it takes both time and aptitude to learn to write excellently. The most apt students will develop into very good writers; but many good technical students lack aptitude for writing, and academic programs often do not allow much time for training in technical writing. Second, although it is probably out of the question to train the average student of engineering and science to write really top-flight reports (not to mention the many other types of material which must be written in connection with scientific and technical work), adequate training can prepare him to write acceptable reports. If, however, the profession is unwilling or unable to devote the necessary time to training in writing, it will have to turn to the use of technical editors, or content itself with inferior writing. If editors are used, (and this use seems to be the solution a growing number of companies are turning to) industry will not only have to pay them well, because of the unusual combination of skills required, but it will also have to grant them the same dignity and respect accorded to other professional men. Finally, if editors are used, both industry and educational institutions will have to encourage students to prepare themselves for editorial posts.

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. . . *Affects Efficiency*

Noise makes people grumpy; it also lowers all the faculties, dulls mental

processes, and makes people irritable and pessimistic. People react to noise and fear in about the same manner. These are some of the conclusions presented by R. Allen Wilson, a noise expert, in a recent discussion concerned with improving working conditions in offices and plants.

The effect of noise in terms of fatigue and inefficiency has long been neglected or underestimated. In a telegraph office it was found there was a 43 percent reduction in errors after the noise had been lowered from 50 to 35 decibels—and, furthermore, a 3 percent reduction in the cost of the messages.

Measurements of caloric energy expended show that in the case of typists 90 percent more energy goes into their work if done in noisy rooms. Wilson has estimated the cost of noise to business at approximately $4 million a day.

Another noise expert, H. C. Hardy, has cited experiments that show noise reduction has resulted in increases in efficiency as great as 9 percent; reduction of errors by 30 to 50 percent; reduction in absenteeism and employee turnover of 50 percent.

—*Business Management*

OLDER WORKERS

. . . *New Facts*

Absenteeism and injury-frequency rates are lower, on the average, for employees aged 45 years and over than for their younger co-workers, according to a recent report of the U. S. Labor Department's Bureau of Labor Statistics.

Even under wartime pressures, however, industry has hesitated to employ the older worker until all other supplies of manpower have been exhausted. In the postwar years, especially, periods of unemployment have tended to have severe repercussion on workers 45 and over, who now constitute over one-third of our labor force.

Among the topics covered by the bulletin, *Employment and Economic Status of Older Men and Women*, are public and private pension and retirement programs, sources and size of older people's incomes, and the job experience of older workers. Copies of the publication are available at 30 cents each from the Superintendent of Documents, Washington, D. C. —*End*

Big New Bulletin

...how to select the proper heat exchanger

This new Whitlock Bulletin No. 250 — just off the press — tells all about our complete line of standard heat exchangers. The bulletin shows you how to save money by selecting standard designs. It points out the characteristics of individual designs to help pick the right standard heat exchangers to meet your needs . . . and gives new tables that make it easy for you to determine sizes.

1. Eight standard types — Straight Tube, U-Tube, Double-Pipe, Coil Type, etc.
2. Complete dimensional tables, including construction details.
3. Listing of standard and special construction materials.
4. Full line of auxiliary process equipment.

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THE WHITLOCK MANUFACTURING CO.
94 SOUTH ST., HARTFORD 10, CONN.
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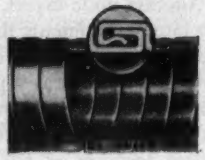
Whitlock designs and builds bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

CMH

One dependable source for every flexible metal hose requirement

CMH corrugated hose is available with metal braid covering or unbraided in steel, bronze or stainless steel. Used where great flexibility is required at high temperatures and high pressures. Sizes range from ¾″ I.D. to 24″ I.D. Depending on size, type and material, it will handle burst pressures to 12,000 psi, temperatures to 1200° F.

CMH interlocked hose is available in various types, packed and unpacked, in steel, stainless steel, bronze, aluminum, brass and other metals. It is used for steam, exhaust, tar and asphalt, etc. Sizes ½″ to 12″, I.D. Depending on size, type and material, it may be used for working pressures to 750 psi (constant), temperatures to 600° F.

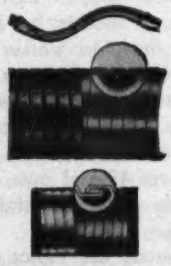


CMH double groove (ball bearing design) hose is available in bronze, steel or stainless steel with asbestos packing and with or without metal braid covering. Widely used for non-searching liquids and gases at low to moderate pressures and temperatures. Sizes range from ½″ to 1¼″, I.D.

CMH square locked hose is available unpacked or with a choice of several types of packing in steel, bronze, brass, aluminum, stainless steel, etc. It is used as conduit, cable armor, nozzles and many similar applications. Sizes range from ¼″ to 1″, I.D. Normally used only at very low pressures.

For full information on all CMH hose products write for Catalog 130 or see the Flexonics catalogs in Sweet's Plant Engineering File, Chemical Engineering Catalog and The Refinery Catalog. For maintenance hose, see the classified pages of your telephone directory for the name of your CMH distributor.

Standard assemblies and special purpose flexible metal hose items are manufactured for such services as steam, tar and asphalt, machine tool coolants, machine tool wiring conduit, dry granular products. We will be pleased to send data on any specific requirement.



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Flexon identifies CMH products that have served industry for over 50 years.

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Expansion joints.

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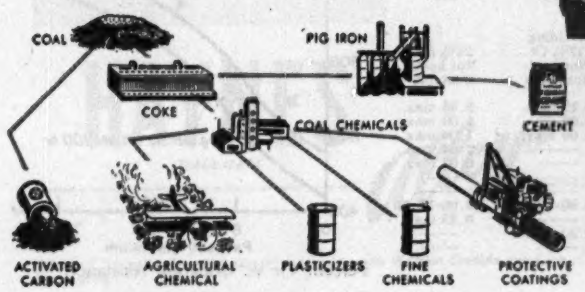
EVERY TIME this big unloading bucket bites into a bargeload of coal, we're starting another chemical miracle on its way to you. Your new synthetic fiber suit, the drug that "knocked" your flu so fast and the bright enamel on your new car could all have been born in the coal chemical recovery mains of our coke ovens.

But *this* may be the real miracle: From our coking operations we produce not only coke and coal chemicals, but we follow through with basic products like pig iron and cement on one hand and finished chemical products like Pittsburgh Insecticides and Dyestuffs on the other—all in *one continuous, interlocking operation.* This highly developed integration—and it now embraces ten operating divisions—requires considerable engineering skill and years to perfect. But the payoff is the unusual production efficiency and product quality control that have become synonymous with Pittsburgh Coke & Chemical.

WAD 4841



PITTSBURGH
COKE & CHEMICAL CO.

17% Chromium Stainless Steels

The corrosion resistance of these important materials of construction to a number of corrosives, with physical and mechanical properties and applications in the CPI.

COMMITTEE OF STAINLESS STEEL PRODUCERS
American Iron and Steel Institute

NOTE: *This is one of a series on stainless steels. Refer to the first article in the series in the April issue for what to consider in the selection of stainless steels regardless of grade.*—EDITOR.

The 17 percent chromium stainless steels show the best combination of corrosion resistance, useful mechanical properties, and good formability of any of the straight chromium types. Added chromium makes them much more corrosion and heat resistant than 12 percent chromium alloys discussed last month. They approach, for some applications, chromium-nickel types 301 and 302 in both fabricating ease and corrosion performance. Unlike the 12 percent chromium alloys or the chromium-nickel grades, however, this group is not hardenable by heat treatment (as is Type 410) nor does it respond to cold work to any great extent (as does Type 302).

The basic 17 percent chromium stainless steel is Type 430. Mechanically it is somewhat better than mild steel, and it has better corrosion resistance than Type 410. Though not recommended for low-temperature work because of a tendency towards brittleness, Type 430 does work out in many applications where resistance to oxidation scaling at high temperatures is important. Its low coefficient of expansion as compared to the 18-8 alloys, and its high chromium content help it to retain (under oxidizing conditions) a tight protective scale which remains on the surface of the metal even when the equipment goes through repeated heating and cooling.

Type 430 can be successfully welded, but care must be taken to weld at minimum temperatures for the shortest allowable time. Exposure of Type 430 to welding heat may cause rapid grain growth and subsequent brittleness at weld boundaries. Application of heat also causes the formation of martensite, and under some conditions this appears to increase the alloy's susceptibility to corrosive attack.

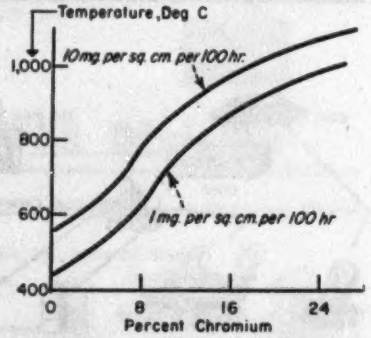
For assemblies that require a great deal of welded fabrication, however, Type 430T can be specified. Type 430T (or sometimes Type 430Ti) is a non-standard titanium-containing modification of Type 430 especially produced for its good welding qualities. The presence of titanium (0.30-0.70 percent) apparently inhibits the formation of martensite in the weld metal and surrounding areas. Type 430T welds are therefore more ductile than Type 430 welds in the as-welded condition.

If machinability in the 17 percent

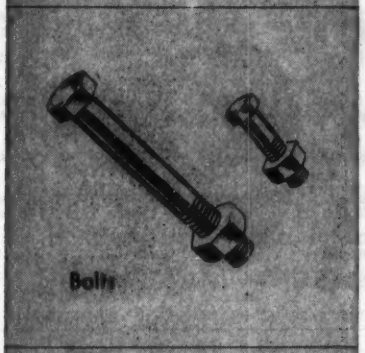
Chemical Composition, Percent

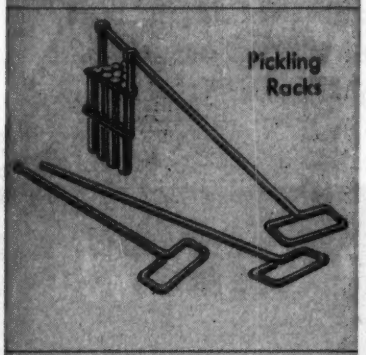
AISI Stainless Type	430	430F	430T	446
Nominal designation	Basic 17% Cr Not heat-treatable	Free Machining 17% Cr Not heat-treatable	Welding 17% Cr Not heat-treatable	24% Cr Not heat-treatable
Carbon	0.12 max.	0.12 max.	0.12 max.	0.35 max.
Manganese	1.00 max.	1.25 max.	1.00 max.	1.00 max.
Silicon	1.00 max.	1.00 max.	1.00 max.	1.00 max.
Phosphorus	0.04 max.	*	—	0.04 max.
Sulfur	0.03 max.	*	—	0.03 max.
Selenium	—	*	—	—
Mo or Zr	—	0.06 max.	—	—
Chromium	14.00-18.00	14.00-18.00	16.00-18.00	23.00-27.00
Nitrogen	—	—	—	0.25 max.
Titanium	—	—	0.30-0.70	—
Aluminum	—	—	—	—

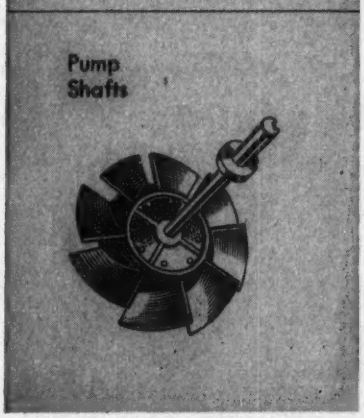
* P, S or Se 0.07 min.



Percent Cr vs. oxidation resistance.







HAYNES Alloy Bar Stock

Trade-Mark

FOR SEVERE SERVICE CONDITIONS

Four different HAYNES alloys are available in hot-rolled and forged bar stock for the fabrication of parts subjected to heat, corrosion, or oxidation. Each alloy has an unusual combination of properties to combat certain severe service conditions, as indicated by the chart below. Typical parts made from HAYNES alloy bar stock are piston rods, valve stems, pickling racks, pump shafts, bolts, needle valves and forgings such as automotive valves and turbine blades.

Round bars are available in diameters from 3½ in. down to ¼ inch. Rounds larger than 3½ in. in diameter can be obtained as hot forgings.

HAYNES alloy bars can be turned, ground, drilled, tapped, reamed, threaded, and welded.

For further information about HAYNES alloy bar stock, contact the nearest Haynes Stellite Company district office.

USE BAR STOCK OF	FOR RESISTANCE TO
HASTELLOY Alloy B (nickel-molybdenum-iron)	Hydrochloric acid, wet hydrogen chloride gas, sulphuric acid, phosphoric acid, organic acids, high temperatures.
HASTELLOY Alloy C (nickel-molybdenum-chromium-iron)	Nitric acid, free chlorine, acid salts, hydrochloric acid, sulphuric acid, phosphoric acid, organic acids, sulphurous acid, high temperatures.
MULTIMET Alloy (cobalt-chromium-nickel-iron)	Oxidation, high temperatures.
HAYNES Alloy No. 25 (cobalt-chromium-tungsten-nickel)	Oxidation, high temperatures, carburization, wet chlorine, nitric acid.

HAYNES TRADE-MARK *alloys*

"Haynes," "Hastelloy," and "Multimet" are trade-marks of Union Carbide and Carbon Corporation.

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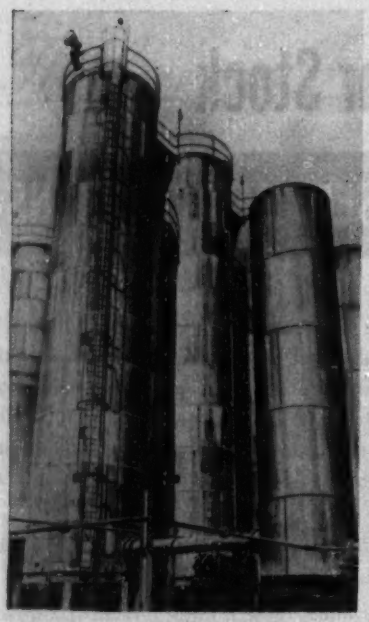


chromium stainless corrosion range is of primary importance, then Type 430F is usually specified. A phosphorus, sulfur, or selenium-containing alloy, Type 430F displays machinability characteristics almost equal to those of Type 416 (90-95 percent Bessemer Screw stock).

Although not covered by corrosion charts in this series, there is another non-hardenable chromium stainless steel, Type 446, which finds special application in the chemical industry for its high temperature resistance both to scaling and to sulfur-containing flue gases.

A 23-27 percent chromium-bearing grade, this alloy has some toughness at moderate temperatures but becomes brittle after heating to temperatures exceeding 875 deg. F. then cooled to room temperatures. Ductility at elevated temperatures is regained upon reheating. For many applications such as rotary dryers, retorts, and combustion chambers where good corrosion and scale resistance is essential, Type 446 is doing a fine job.

Again, the charts that accompany this article are meant only as guides to an understanding of the 17 percent chromium stainless steels. Actual specification of these alloys for a given corrosive situation should wait on specific tests carried out under the same conditions as those under which the equipment will have to operate.

As in the previous stainless steel articles, corrosion charts were adapted from "Corrosion Data Survey," G. A. Nelson, copyright by Shell Development Co., Emeryville, Calif.

Typical Applications of 17 Percent Chromium Stainless

- Nitric acid plant equipment (absorption towers, condenser piping)
- Nitrogen fixation apparatus
- Tank cars for nitric acid
- Rubber plant machinery
- Soda-pulp evaporators
- Paddles
- Furnace linings, flue linings
- Fractionating equipment
- Control of sulfur-bearing gases

Representative Mechanical Properties*

AISI Stainless Type	430	430F	430T	446
Sheets and strip, annealed				
Tensile strength, psi	75,000	——	65,000	80,000
Yield strength, psi	45,000	——	45,000	50,000
Elongation in 2 in., %	25	——	30	20
Rockwell hardness	B-80	——	B-78	B-83
Bars, annealed				
Tensile strength, psi	75,000	80,000	——	80,000
Yield strength, psi	45,000	55,000	——	50,000
Elongation in 2 in., %	30	25	——	25
Brinell hardness	155	170	——	170
Endurance limit, psi	40,000	45,000	——	47,000
Bars (1"), cold drawn				
Tensile strength, psi	85,000	90,000	——	85,000
Yield strength, psi	70,000	80,000	——	70,000
Elongation in 2 in., %	20	15	——	20
Brinell hardness	185	190	——	185
Endurance limit, psi	46,000	48,000	——	——

*From AISI Steel Products Manual, Section 24, April 1950.

Effect of Temperature on Properties*

AISI Stainless Type	430	430F	430T	446
Creep strength, annealed, psi. (1% set in 10,000 hr.)				
1,000 F	8,500	——	8,500	6,000
1,100 F	4,300	——	4,300	3,000
1,200 F	2,200	——	2,200	1,500
1,300 F	1,300	——	1,300	700
1,500 F	——	——	——	300
Maximum service temperature (in air), F.				
Continuous	1,500	1,500	1,500	2,000
Intermittent	1,550	1,550	1,550	2,050
Low-temperature (−80 F.) properties, annealed				
Tensile strength, psi	81,000	——	——	——
Yield strength, psi	44,000	——	——	——
Elongation in 2 in., %	36	——	——	——
Izod impact, ft-lb	5	——	——	——

*From AISI Steel Products Manual, Section 24, April 1950.

Physical Properties & Working Characteristics of Annealed Chromium Stainless Steels*

AISI Stainless Type	430	430F	446
Modulus of elasticity in tension, psi	29×10^6	29×10^6	29×10^6
Density, lb./cu. in.	0.28	0.28	0.27
Density, g./cc	7.7	——	7.6
Specific electrical resistance at room temp., microohms/cm./cm.²	60	60	67
Magnetic permeability	Ferromagnetic	Ferromagnetic	Ferromagnetic
Specific heat, Btu. lb./°F. (32-212 F.)	0.11	0.11	0.12
Thermal conductivity, Btu./hr./ft.²/per ft./deg. F. 212 F.	15.1	15.1	12.1
Thermal conductivity, Btu./hr./ft.²/per ft./deg. F. 392 F.	15.2	——	12.7
Thermal conductivity, Btu./hr./ft.²/per ft./deg. F. 572 F.	15.2	——	13.3
Thermal conductivity, Btu./hr./ft.²/per ft./deg. F. 752 F.	15.2	——	13.8
Thermal conductivity, Btu./hr./ft.²/per ft./deg. F. 932 F.	15.2	15.2	14.1
Mean coefficient of thermal expansion/deg. F. 32-212 F.	5.8×10^{-6}	5.8×10^{-6}	5.8×10^{-6}
Mean coefficient of thermal expansion/deg. F. 32-600 F.	6.1×10^{-6}	6.1×10^{-6}	6.0×10^{-6}
Mean coefficient of thermal expansion/deg. F. 32-1,000 F.	6.3×10^{-6}	6.3×10^{-6}	6.2×10^{-6}
Mean coefficient of thermal expansion/deg. F. 32-1,200 F.	6.6×10^{-6}	6.6×10^{-6}	6.4×10^{-6}
Mean coefficient of thermal expansion/deg. F. 32-1,500 F.	6.9×10^{-6}	6.9×10^{-6}	6.7×10^{-6}
Max. temp without excessive scaling, F.	1,550	——	2,000
Melting point range, F.	2,600-2,750	2,600-2,750	2,600-2,750
Forging practice, Initial temp. F.	1,900-2,050	1,950-2,100	1,950-2,050
Forging practice, Final temp. F.	1,400-1,500	——	1,300-1,450
Forging practice, Method of cooling	Air cool	——	Air cool
Annealing temperatures, F. Low anneal	Rapid cool from 1,400-1,450	1,250-1,400	Rapid cool from 1,450-1,600
Annealing temperatures, F. Full anneal	——	——	——
Hardening temp., °F.	Not appreciably hardenable	Not appreciably hardenable	Non-hardenable

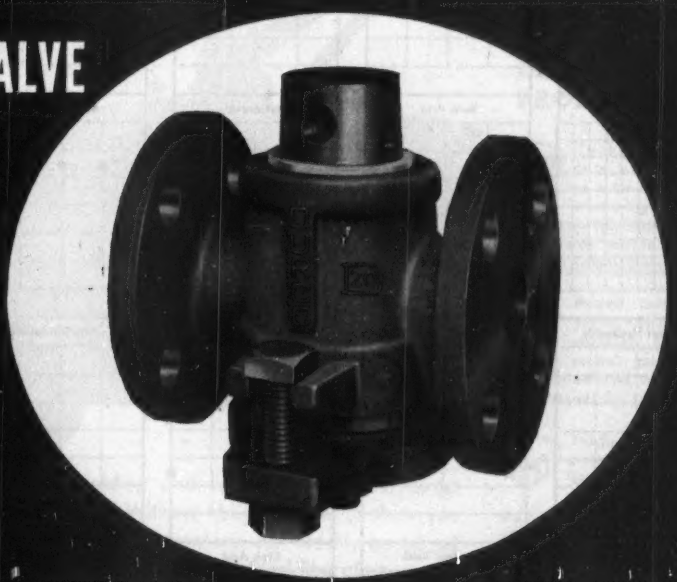
*From AISI Steel Products Manual, Section 24, April 1950.

The one chemical service valve

seven ways better

In the past, just one or two of these advantages were enough to justify the use of a particular chemical service valve. Now DURCO engineers have designed a valve with all seven features. With several thousand in operation in the three years since they were introduced, the list of successful applications is large and varied. If you have a troublesome corrosion problem, call the DURCO representative near you, or write The Duriron Company, Inc., Dayton, Ohio.

DURCO TYPE F VALVE



*Registered trade-mark of E. I. duPont de Nemours & Co., Inc., for its tetrafluoroethylene resin.

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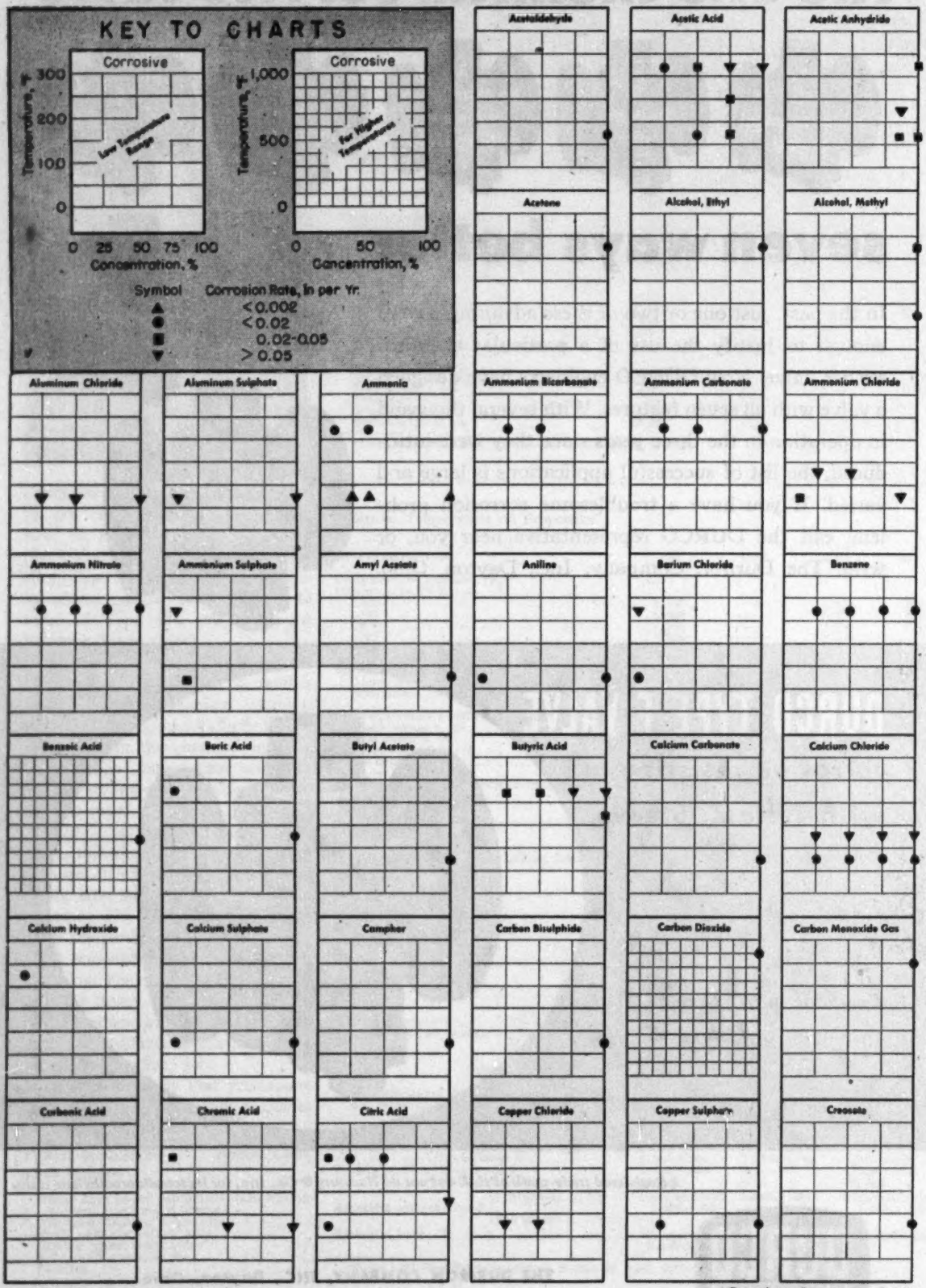
CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON COMPANY, INC., Dayton, Ohio

Corrosion Resistance of 17% Chromium Stainless Steels



(Continued on page 266)

HIGH SPEED MILLS WILL CUT YOUR PRODUCTION COSTS

NEW ROSS #52T— THREE ROLL MILLS

prove time and again to give maximum output with highest quality grinding or dispersion results.

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Compare these features built into every ROSS Mill:

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8. Special bearings in handwheels facilitate rapid setting or disengaging of rolls. Parallel settings obtained with indicating dials for sensitive accurate adjustment. Setting is direct, has no intermediate wearable parts, will not lose effectiveness or accuracy.

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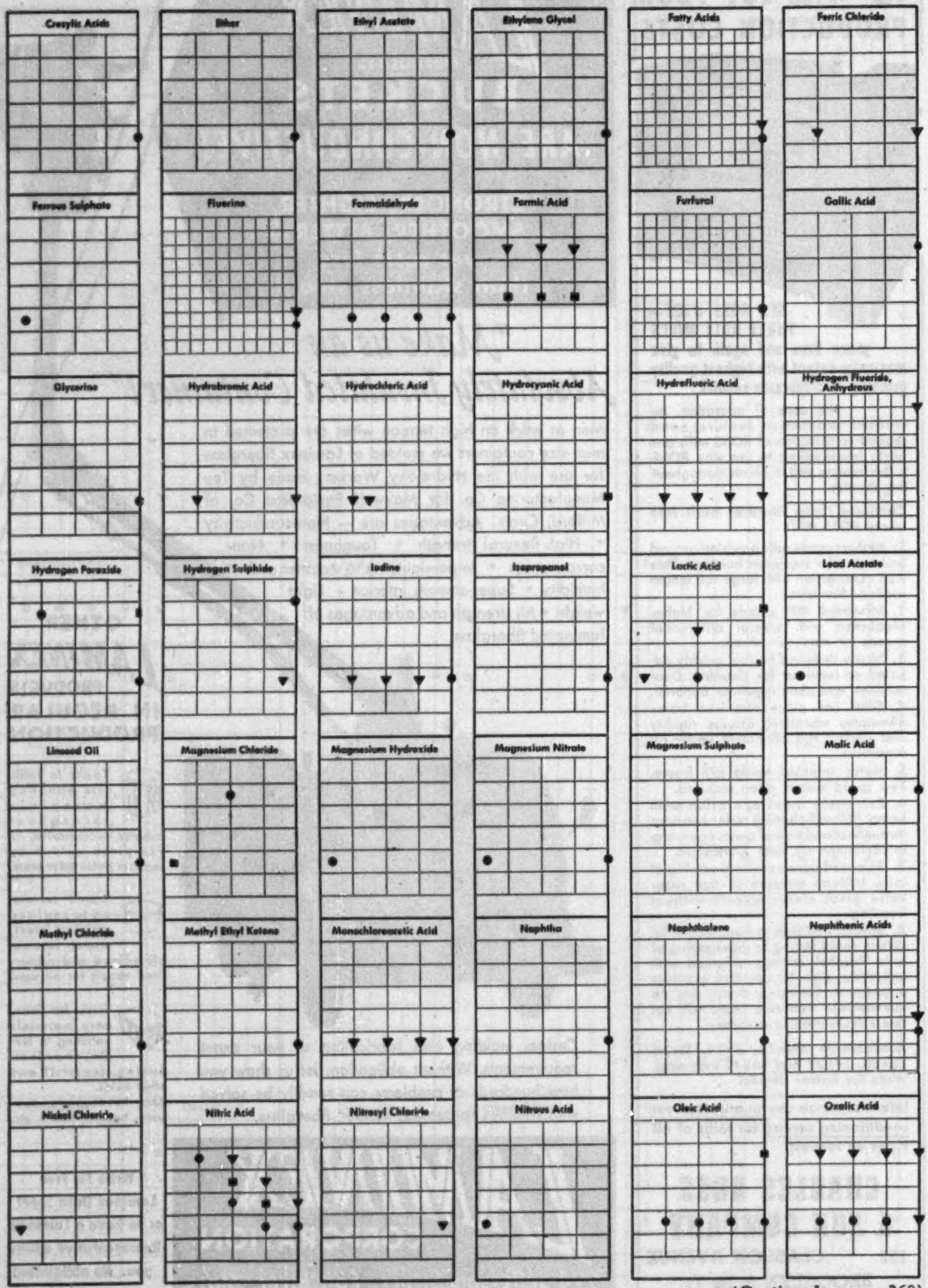
Corrosion Resistance of 17% Chromium Stainless Steels



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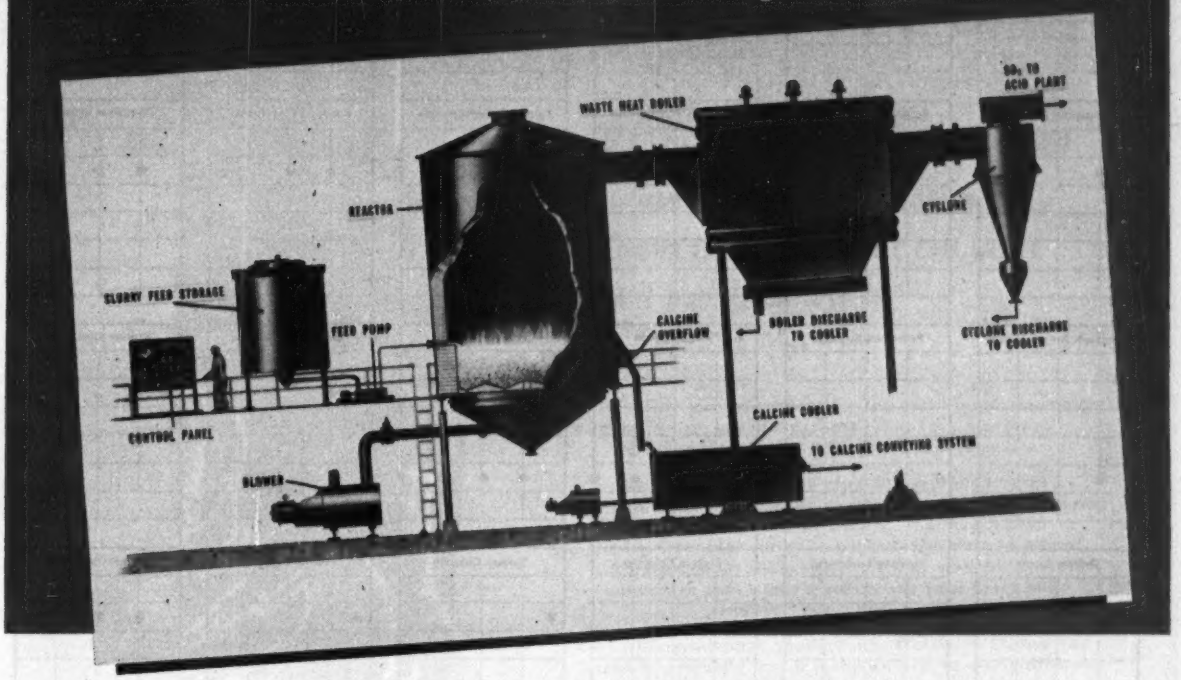
Alcan First to Roast Zinc Concentrates with DORRCO FLUOSOLIDS System



Produces SO_2 for Contact Acid Plant and Desulfurized Zinc Calcine for Leaching

ARVIDA, QUEBEC. First commercial installation for fluidized zinc roasting, a Dorrco FluoSolids System has been on stream at the Aluminum Company of Canada's plant here since June, 1952. Alcan's expanding primary aluminum capacity has increased their sulfuric acid requirements and FluoSolids was selected as the most economically and technically feasible method to produce SO_2 from zinc sulfides for contact acid manufacture. It frees this company from fluctuations in natural sulfur supplies and at the same time gives a calcine ideally suited for electrolytic zinc production.

SYSTEM ROASTS 150 TONS PER DAY

Results from the first year of operation have been completely satisfactory. Gas strength at the Reactor stack averages 10-12% SO_2 . . . a safe margin over the 7% SO_2 required at the converter. The close temperature control possible with FluoSolids has resulted in a combined calcine product averaging 0.3% sulfide sulfur . . . which is the specification on this calcine for electrolytic zinc.

HOW THE SYSTEM WORKS

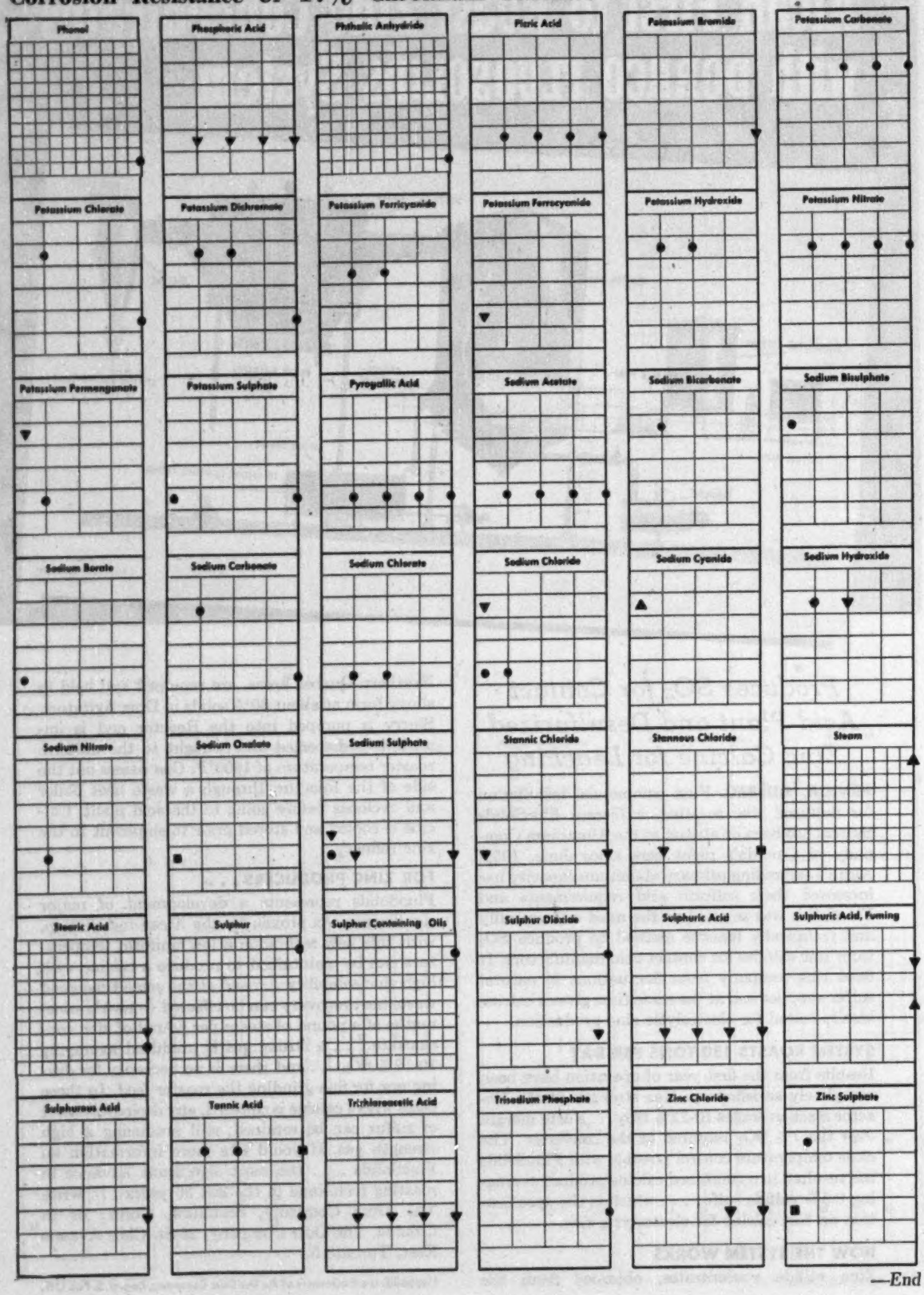
Zinc sulfide concentrates, obtained from the Northern Quebec areas, are repulped and held in slurry form at about 80% solids in Dorr Agitators. Slurry is pumped into the Reactor and is immediately dispersed and brought to the uniform roaster temperature of 1600°F. Gas passes out the side of the Reactor, through a waste heat boiler and cyclones before going to the acid plant. Calcine is cooled and stored prior to shipment to the zinc refinery.

FOR ZINC PRODUCERS . . .

FluoSolids represents a development of major significance. As proven by the Alcan installation, with this new technique a low uniform temperature can be maintained to produce a calcine with high zinc solubility . . . and at the same time good waste heat recovery can be effected — nearly nine-tenths of a pound of steam per pound of zinc concentrate . . . a strong gas is produced averaging 10-12% SO_2 . . . and there is no necessity for drying nor for fine grinding the roaster feed. In those cases where calcine is sintered, any desired amount of sulfur can be retained, still producing a high strength gas. If you'd like more information on FluoSolids . . . the most significant advance in roasting technique in the last 30 years . . . write The Dorr Company, Stamford, Conn., or in Canada, The Dorr Company, 26 St. Clair Avenue East, Toronto 5.

FluoSolids is a trademark of the The Dorr Company, Reg. U. S. Pat. Off.

Corrosion Resistance of 17% Chromium Stainless Steels



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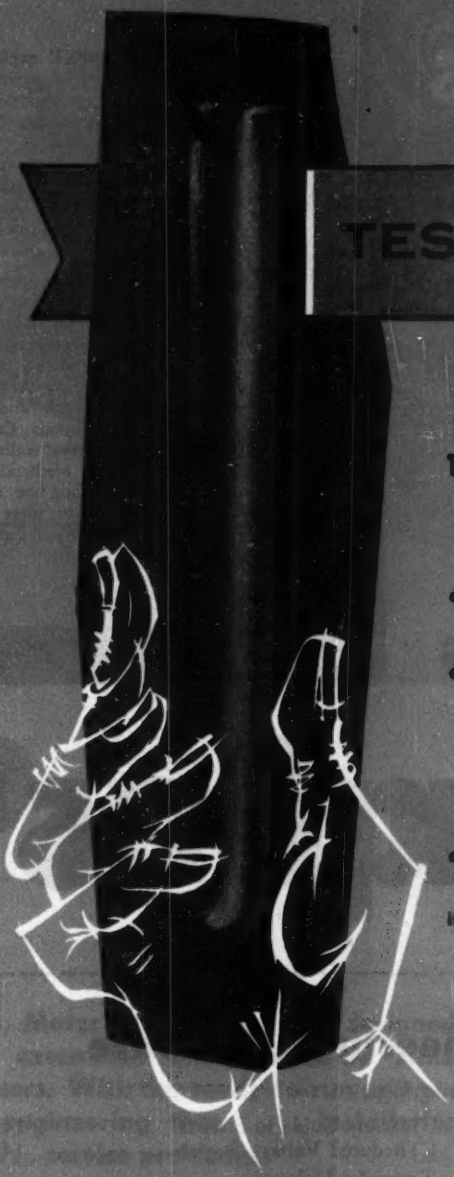


TEST IT YOURSELF

IF YOU HAVE AN OXIDATION PROBLEM . . .
YOUR OWN LABORATORY CAN PROVE
THE VALUE AND VERSATILITY OF

WELSBACH OZONE

Only you can determine the exact requirements for an oxidant in your present process . . . or for an oxidant to aid in developing new and better products.

Welsbach Ozone may meet those requirements . . . and you can check its economy and dependability easily and quickly in your own laboratory. The Model T-23 Laboratory Ozonator can give you enough data to prove Welsbach Ozone's efficiency and versatility . . . enough to prove that it will lower your costs and increase your profits.

In widely different applications, Welsbach Ozone has shown industry that it is the answer to many difficult oxidation problems. And its unique properties make it outstandingly superior to ordinary conventional oxidants.

Because Welsbach Ozone is delivered to the point of use, it presents no procurement problems, there is no storage expense and no materials handling.

No full-time supervision or labor is necessary in producing Welsbach Ozone, operating costs are constant and predictable and maintenance costs negligible. Since only oxygen is added, purer products are possible . . . and, unlike ordinary oxidants, it reacts quantitatively and instantaneously at ordinary temperature and pressure.

Welsbach Ozone *is* the oxidant of choice.
And you can test it yourself . . . for positive proof that it can lower costs and increase profits . . . for you!

IN YOUR OWN PROCESS . . .
IN YOUR OWN LABORATORY . . .
CHECK THE POTENTIAL OF

WELSBACH OZONE

THE WELSBACH CORPORATION
OZONE PROCESSES DIVISION
1500 WALNUT STREET, PHILADELPHIA 2, PA.

PIONEERS IN CONTINUING OZONE RESEARCH

ALLIS-CHALMERS

PROCESS PUMPS

Here's Why An Allis-Chalmers Complete Pumping Unit Is Your Best

Allis-Chalmers Type APKK explosion-proof motor. Fin-type design with no enclosed passages for external cooling air. Cannot clog and overheat. If cleaning is required, it takes only a few minutes with cloth, brush, vacuum or air hose. All cast-iron frame resists corrosion. Similar design available in totally-enclosed, fan-cooled motors for non-hazardous locations.

Allis-Chalmers oil-lubricated, frame-type pump. Will handle many process jobs at less cost than usual refinery pump. Available with capacities to 1200 gpm, heads to 250 feet and temperature range to 550 F. Built with wide choice of materials to handle many types of corrosive liquids. Can be provided with six different sealing arrangements, including mechanical seal and water-cooled stuffing box. As you can see from the picture, there is plenty of room between the pump and the bearing for maintenance.

Send for Free Engineering Literature

Motors

- ☐ Handy Guide to Motor Selection 51B6052
- ☐ Explosion-proof Motors (APZZ) 51B7286
- ☐ Explosion-proof Motors (AZZ) 51B7149

Pumps

- ☐ Handy Guide to Pump Selection 52B6059
- ☐ Oil-Lubricated, Frame-type Pumps 52B7638

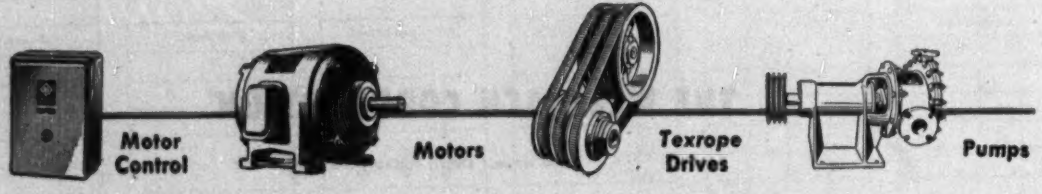
Control

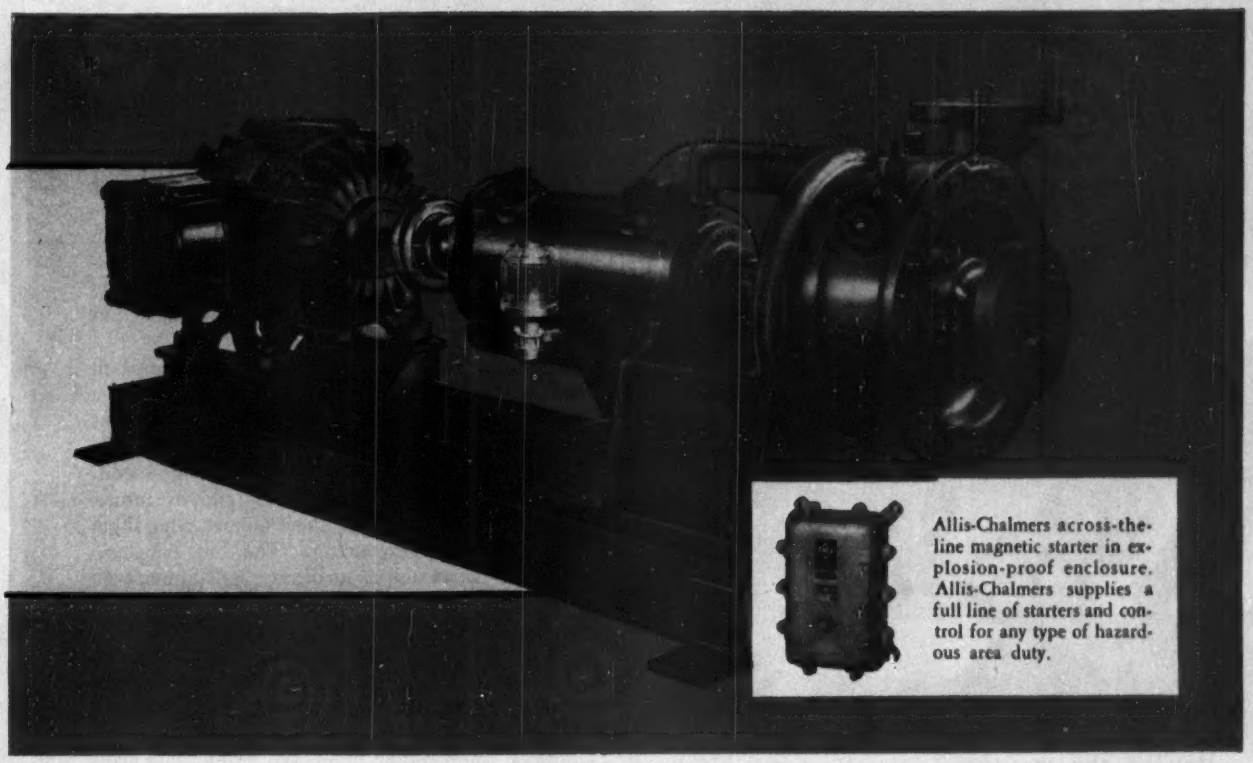
- ☐ Handy Guide to Starters 14B7733
- ☐ Reduced Voltage Starters 14B7215

Texrope Drives

- ☐ Handy Guide to *Texrope* Drives 20B6051

COMPLETE SERVICE *from power line to machine*





Allis-Chalmers across-the-line magnetic starter in explosion-proof enclosure. Allis-Chalmers supplies a full line of starters and control for any type of hazardous area duty.

Pump Buy

Pump, Motor and Control are designed, built, assembled and tested by Allis-Chalmers. With this ready-to-run unit you save engineering time . . . installation costs . . . service problems.

YOU CAN SAVE the time and expense of engineering a pumping unit from several manufacturers' catalogs. Allis-Chalmers will supply the complete pumping unit, with all parts of coordinated design and manufacture, ready to install and run. This engineering service costs you nothing extra.

No Service Problems

The complete unit is guaranteed by one reliable manufacturer, Allis-Chalmers. No buck passing on performance responsibility. Nearly a hundred Allis-Chalmers Certified Service Shops provide factory-approved service in every large industrial area.

Get Complete Information

Get help on your pumping problems by calling an experienced Allis-Chalmers pump application engineer at your nearby Allis-Chalmers District Office.

A-3974

Texrope is an Allis-Chalmers trademark.

ALLIS-CHALMERS

MILWAUKEE 1, WISCONSIN

Names in the News

Man of the month:

Charles S. Munson

Air Reduction's Chairman of the Board, Chairman of MCA, he will receive the Chemical Industry Medal for 1953.

Charles S. Munson, Yale '12, helps direct more corporations than most people could name. He sits on the board of organizations ranging from the Guaranty Trust of New York to the Consolidated Edison Co.

His top job is Air Reduction Co. where he has spent his entire business career and is now Chairman of the Board of Directors.

His top interest is the chemical industry where he has served continuously since 1946 as president or chairman of the Manufacturing Chemists Association. Under his guidance the association has established itself as spokesman for the industry. It is in recognition of this work that the medal, most coveted award in the industry is being given to Munson.

In spite of his terrific schedule, "Carl," as his friends call him, is a man primarily interested in people—whether those people be his employees, his associates or his customers and public. Ask him about one of his myriad accomplishments and he'll tell you "John Smith deserves the credit for that one." Five minutes later he'll have you talking about yourself, he adroitly assuming the role of eager listener.

It is these qualities of human warmth, interest in people and faith of the industry that have made Charles S. Munson. For executive ability is just that: ability to multiply your own efforts through others, aided by genuine faith in the value and future of what you're doing.

Anyone who strips the definition of an executive of all the fancy-sounding half-truths and nonsense knows that a real executive is a man who lets you work his plan but leaves you with the impression that it was your plan in the first place, then sees that you get most of the credit.

With regard to faith in the industry and its future, Munson has no soft words for the timorous who think that chemicals are overexpanding. "The big, long-term jobs belong to chemicals—in medicine, agriculture, even atomic energy. To put it simply, people will always want new things and they will always want better things. The new and the better are certainly the special sphere of the chemical industry. We aren't bound to sell horses if the market is for automobiles. We're not an industry which is saddled with a fixed line of products for which there may be a saturation point in the market. We can move in many directions, with the research man, the perceptive salesman and, above all, the skilled executive showing the way."

Munson's chief concern for the future of the industry is the shortage of technical personnel and the shortage of executives. "The two shortages are one," he says, "since more and more technical men are running our industry." This is one of the many problems that MCA is attacking full-tilt—getting high-school students to tackle engineering and chemistry as a career. On the agenda and squeezing the budget right now is a film designed to show the high-school youngster the desirability of a chemical career.

MCA has also tackled the problem of air and water pollution. A really comprehensive study of water pollution is underway. In other areas the association is continuing and intensifying its efforts in packaging, safety and public relations.

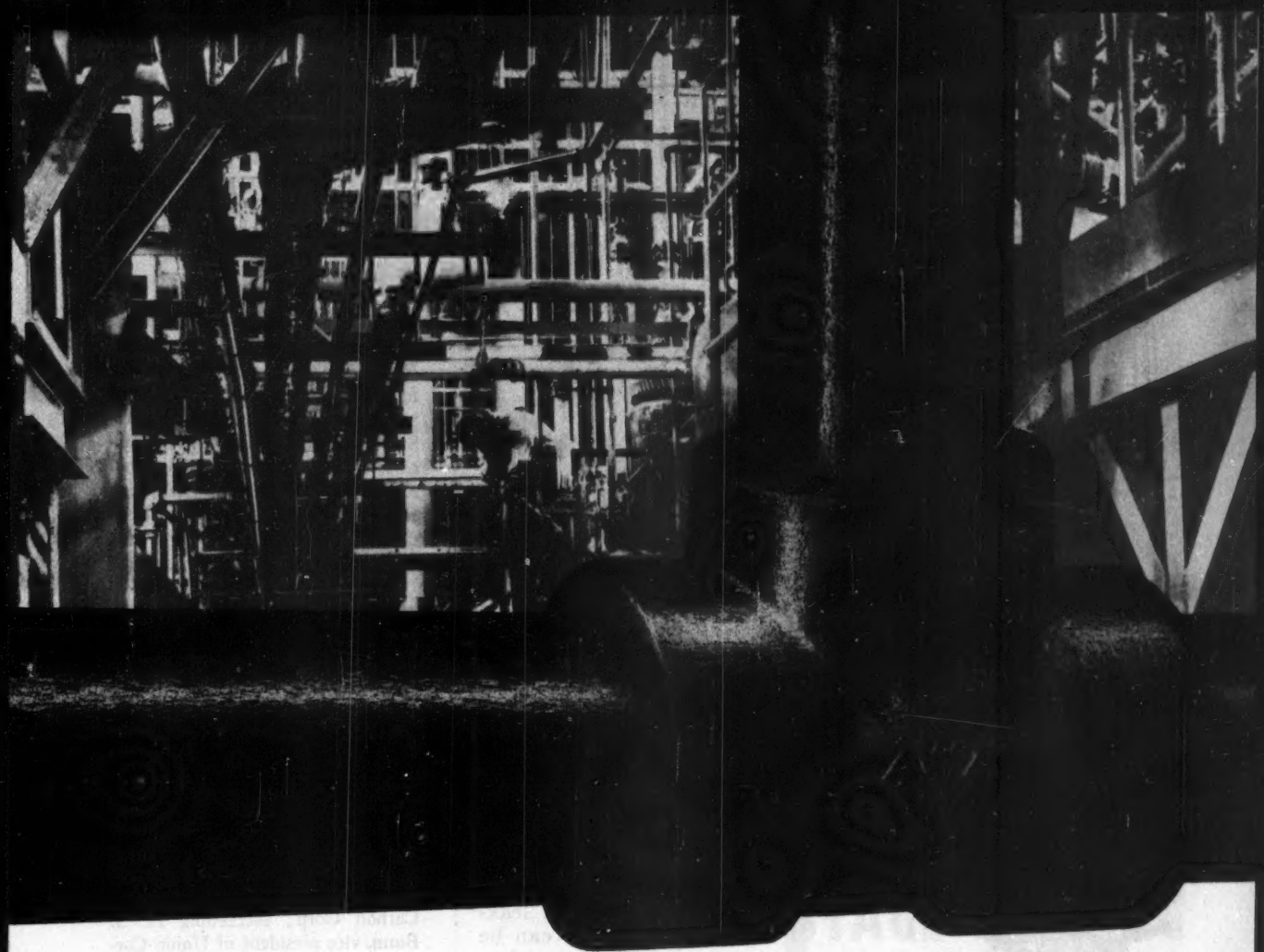
"This aspect of public relations is especially important," says Munson, "it's time to remind the public—and ourselves—that our potential contributions to society over the long pull have hardly begun. We have only gone the first mile on the road to better health, proper soil treatment, conservation of natural resources, control of pests, and peacetime applications of atomic energy.

"In short, this will be a busy—and we hope, fruitful year for the Manufacturing Chemists Association."

To which we'd only add, a busy year, too, for one of the very few men whose name has become synonymous with the chemical industry.

Edward N. Chilson. From vice president to chairman of the board of The J. G. White Engineering Corp. New president: **Ford Kurtz,** formerly vice president in charge of engineering since 1949. New vice presidents: **Harold P. Jackson,** in charge of construction, formerly manager of construction dept. since 1941; **Robert H. Barclay,** in charge of engineering, formerly manager of engineering dept. since 1950.

Edward T. Harding. Assistant to general manager, chemical division,



THEY'RE LOOKING DOWN YOUR PIPELINE...

Those twin scourges of industry—Lost Production and High Maintenance—are constantly drawing a bead on economical operation . . . looking down this nation's arteries for the lines of least resistance to heat, pressure and corrosion.

There *is* one way to spoil their aim: make sure that *your* pipe and tubing sections are joined with fittings of a kind that match them in chemical and physical properties, in strength and weight.

W-S Double-Diamond FORGED STEEL Fittings in both screw-end and socket-weld types give you all these qualities . . . provide life-of-the-line joints for any kind of make-up.

Literature is available . . . write for it.

SOLD THROUGH LEADING DISTRIBUTORS

WATSON-STILLMAN FITTINGS DIVISION

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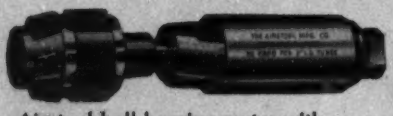

Airetool ball bearing motor with single expansion cutter head for cleaning straight tubes. Motor is slip-fit constructed, and has front and rear ball bearing thrusts.

Airetool direct drive condenser cleaner. Cleans straight tubes ⅜" to 1½" I.D. Air or steam driven. Removes all scale deposits regardless of condition.

Airetool Tube Expansion Control System automatically, accurately rolls tube joints. Eliminates danger of over or under expansion. For field, shop or new work.

Scaled tubes and leaky tube joints cut capacity, increase operating costs. AIRETOOL tube cleaners and tube expanders keep tubes at peak efficiency, reduce down-time due to tube failures. Powerful, high speed cleaners quickly and thoroughly remove even the hardest deposits from straight or curved tubes. Tight, leakproof tube joints can be assured everytime, when they are rolled automatically, accurately, with the unique AIRETOOL Tube Expansion Control System.

You'll have an improved tube maintenance program and better tube efficiency if you specify AIRETOOL tube cleaning and tube expanding equipment. Do it today. Literature upon request.

There's an Airetool Tube Cleaner and Tube Expander For Every Type of Tubular Construction.

AIRETOOL
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BRANCH OFFICES: New York • Chicago • Philadelphia • Houston • Tulsa • Baton Rouge • Hudson Heights (N.J.)
REPRESENTATIVES in principal cities in U.S.A., Canada, Mexico, South America

NAMES IN THE NEWS, cont. . .

Corn Products Refining Co. Formerly in company's engineering dept. New director of development and training in company's industrial relations dept.: **John S. Wilson.** Formerly personnel manager of chemical division.

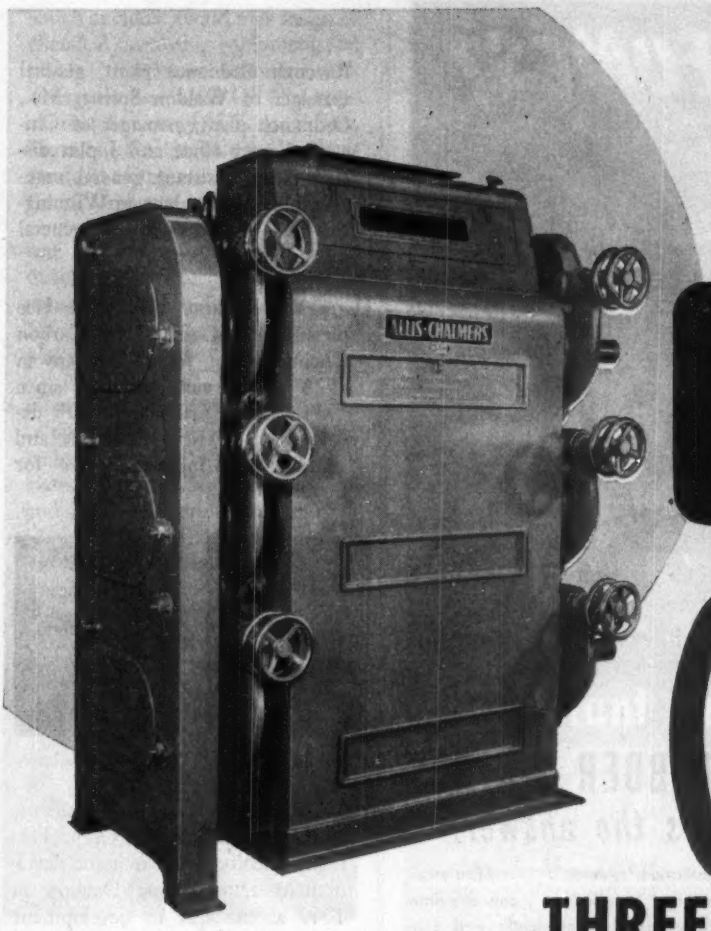
William C. Foster. President, Manufacturing Chemists' Association. Formerly Deputy Secretary of Defense, Administrator of ECA, and president of Pressed and Welded Steel Products Co. Other MCA officers: **Charles S. Munson,** chairman of the board; **F. J. Emmerich,** vice chairman; **Paul L. Davies** and **Kenneth C. Towe,** vice presidents; and **M. F. Crass, Jr.,** secretary-treasurer.

William C. Foster

George C. Miller

George C. Miller. President, Bakelite Co., division of Union Carbide and Carbon Corp., succeeding **H. S. Bunn,** vice president of Union Carbide, who becomes chairman of Bakelite and a member of the Appropriations Committee of Union Carbide. Mr. Miller joined Linde Air Products Co., a Union Carbide division, in 1922; then a field engineer and construction engineer for Carbide and Carbon Chemicals Co. before transferring to Bakelite's early development work on plastics. Has been general sales manager of Bakelite's thermoplastics dept., vice president and general sales manager and most recently vice president in charge of sales.

D. J. C. Copps. General manager, explosives dept., Atlas Powder Co., elected to board and executive committee of Atlas upon retirement of **W. G. Frome,** vice president, member of the board and of the executive committee, and veteran of 43 years in the explosive industry. Mr. Copps joined Atlas in 1929 as assistant plant engineer, then served as plant engineer, acid supervisor and powder supervisor, chief engineer of



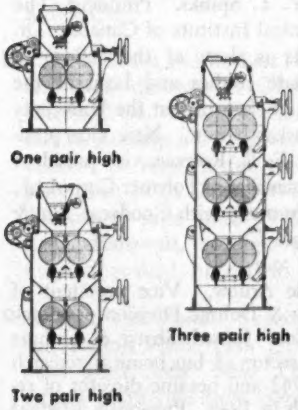
STYLE N

ROLLER MILLS

Gentle

THREE-STAGE MILLING

INCREASES YIELD BY MINIMIZING FINES



One pair high

Two pair high

Three pair high

To meet the varying requirements of the chemical industry, Allis-Chalmers single flow roller mills are also made in one pair high and two pair high types. Milling requirements, of course, dictate the type of mill. Two and three pairs are used when no separation is necessary between stages.

In this Allis-Chalmers roller mill, three progressively finer grindings produce a maximum yield in a single pass. There is no excessive shattering . . . no size-destroying impact. Each grinding is extremely gentle. Granulations are uniform. Fines are kept to a minimum. The necessity of briquetting or pelletizing of fines and the subsequent re-milling is substantially reduced.

How It Works

Three pairs of horizontal rolls are mounted in a vertical line (see drawing). From the input channel, material passes by gravity from one set of rolls to the next — providing three graduated grades of grinding. Mills are available with rolls of nine and ten-inch diameters in 18 to 42-inch lengths.

Construction Features

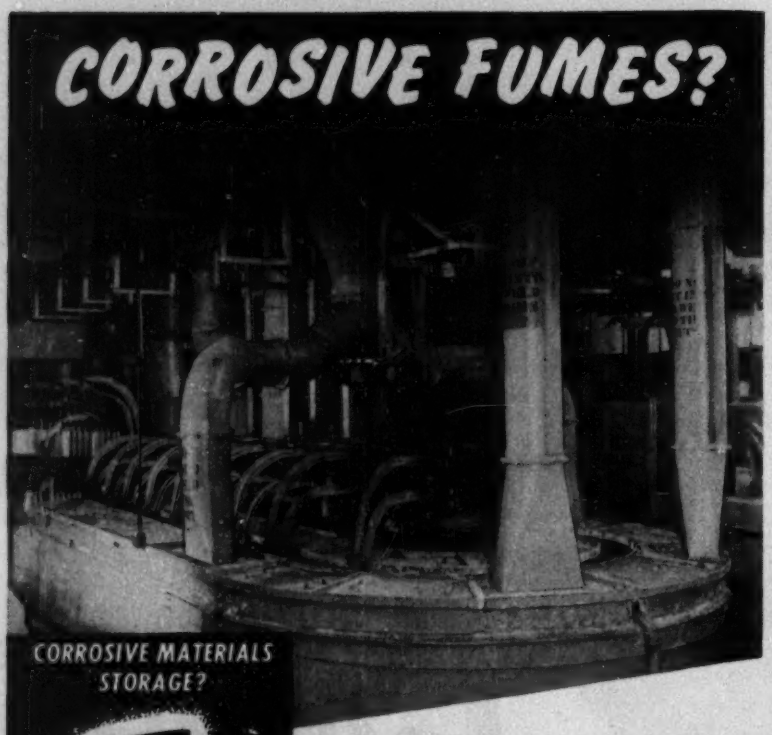
Equipped with its own driving unit, the mill can be conveniently located. Roller chain drives on the differential side provide quiet, trouble-free operation. Bearings of the anti-friction type save power. Long wearing, hard surfaced *Circle-Chill* rolls give "bonus" months of profitable milling. An all welded, heavy steel frame affords maximum rigidity and heavy duty service.

For complete information, see your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4093

Circle-Chill is an Allis-Chalmers trademark.

ALLIS-CHALMERS

CORROSIVE FUMES?



CORROSIVE MATERIALS STORAGE?

ARco rubber lined Handy Tanks—available with or without snap-on covers—stock 10, 15, 30 and 55 gals.—any size made to specifications.

ARco RUBBER LININGS ...that's the answer!

● Complete ventilation systems . . . ARco engineered, fabricated and installed . . . can alleviate your corrosive fumes problem efficiently and economically. ARco know-how, based on years of experience in the chemical field, is your assurance of rubber insulated equipment equal to your needs . . . whether your problem be processing, transportation, ventilation, storage or production.

Your conference with an ARco Engineer will be a good investment in protection . . . for your equipment . . . for your profits!

SEND FOR THIS VALUABLE INFORMATION TODAY!

Literature showing ARco rubber applications to equipment, parts and installations in every industrial field. Write today—see the economy, efficiency and quality ARco offers your operation.

ARco FIELD SERVICE UNITS

● ARco Engineers bring complete technical know-how right into your plant. Permanent installations or equipment too large to move can be fabricated and covered right on the job by ARco Field Service Units.

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ARCO RUBBER PROCESSORS
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MANUFACTURERS • DESIGNERS • ENGINEERS

NAMES IN THE NEWS, cont. . .

Ravenna Ordnance plant, general manager of Weldon Spring, Mo., Ordnance plant, manager of Chicago district office and Joplin district office, assistant general manager of explosives dept. in Wilmington in 1951, and since 1952 general manager of the dept.

Harry B. McClure. Executive vice president of Carbide and Carbon Chemicals Co. Joined company in 1928 and a vice president since 1944. Concerned mainly with development of new chemicals and finding new industrial uses for them.

Harry B. McClure

Paul W. Bachman

Paul W. Bachman. Vice president, The Davison Chemical Corp. Formerly director of research and development after joining Davison in 1949 as manager of development planning. Previously associated with E. I. du Pont de Nemours, General Chemical Co., Victor Chemical Works, and Commercial Solvents Corp.

John W. T. Spinks. President, The Chemical Institute of Canada. Dr. Spinks is dean of the college of graduate studies and head of the dept. of chemistry at the University of Saskatchewan. New vice president: **E. R. Rowzee,** vice president and manager of Polymer Corp. Ltd., and formerly with Goodyear Tire & Rubber Co.

L. Earle Arnow. Vice president of Sharp & Dohme Division of Merck & Co. Joined Sharp & Dohme as director of biochemical research in 1942 and became director of research in 1944. Previously assistant professor of physiological chemistry at U. of Minnesota Medical School.

Walter Lincoln Hardy. Director of engineering, Foster D. Snell, Inc. Formerly director of package engineering. Now responsible for re-

search and development in design of chemical processing equipment and plants. Previously associated with Tidewater Associated Oil Co., engineering division of U. S. Air Forces, Protective Coatings Corp., Shellmar Products Corp. and Leeds Sales Corp. Graduate of Cornell.

Albert M. Stover. Assistant to the director of research and development of the Naugatuck Chemical Div. Formerly manager of Marvinol plastics development.

S. George Bankoff. Head, department of chemical engineering, Rose Polytechnic Institute. Formerly associated with Sinclair Refining Co. and E. I. du Pont de Nemours & Co. With Rose Polytechnic since 1948 and currently working with Reactor Experimental Engineering Division of Oak Ridge National Laboratory. Graduate of Columbia and Purdue.

S. George Bankoff

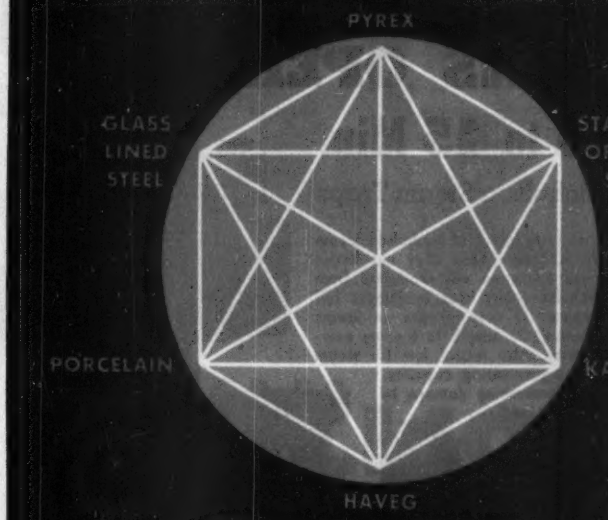
L. C. Johnston

Laurence C. Johnston. Vice president, Brown Fintube Co. Has been eastern district sales manager since 1949. Previously with Process Engineering, Inc. and Patterson-Kelley Co.

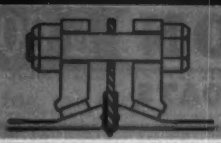
Herbert D. Doan and **Herbert H. Dow II.** New directors of The Dow Chemical Co. New vice presidents: **Ray H. Boundy,** a Dow director and director of research for the company since 1952; **Donald Williams,** director of sales since 1949; and **J. D. Hanawalt,** manager of the magnesium dept. since 1946.

Roscoe L. Van Zandt. Superintendent, Barton Plant, Lion Oil Co.'s new plant near New Orleans. Others transferred from company's headquarters at El Dorado, Ark.; **Stanley B. Johnson,** assistant superintendent; **John L. Ricks,** chief engineer; **H. Leon Payton,** operating superintendent; **Fred B. Elliott,** maintenance superintendent; **Malcolm C. Lowe,** chief chemist; **Cary**

CHEMISEAL MADE OF TEFLON CONNECTIONS

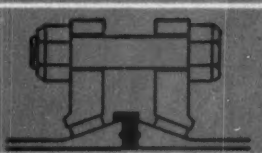


Join All Types of Chemical-Resistant Pipe and Equipment

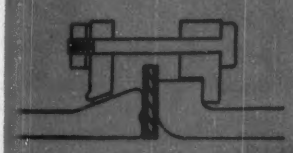


Chemiseal Teflon-Jacketed Gaskets, Types T6N or T6-300 are standard for Corning conical flanges, seal at unusually low bolt loads.

Chemiseal Flexible Couplings No. 202—(Teflon Bellows with two or three convolutions) and Chemiseal Expansion Joints No. 212—(several convolutions), for use in absorbing thermal or mechanical movement and vibration, protecting costly piping. Sizes 1 in. to 12 in. I.P.S. Require no gaskets or adaptors to join unlike piping ends and materials.



Chemiseal Snap-on Type 820 Gaskets. Teflon molded to match contour of conical-end glass pipe, assure perfect centering of joints—free flow of materials. For all standard pipe sizes, ¼ in. to 6 in.



Chemiseal Teflon-Jacketed Adaptors No. 2-CRS, provide a tight, safe seal between unlike piping ends and nozzles. A steel bearing ring provides rigidity. Resilient core assures safe seal at low bolt loads. Teflon Jacket protects and contains easy-to-handle single unit.

UNITED STATES GASKET COMPANY

UGS FLUOROCARBON PRODUCTS DIVISION
CAMDEN 1, NEW JERSEY
Representatives in Principal Cities Throughout the World

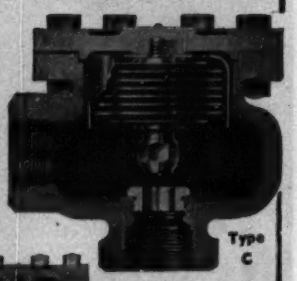
LEADING PROCESSOR

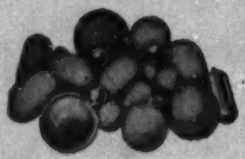
SHORTENS OPERATION

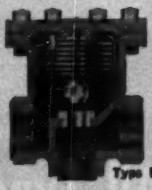
from 65 to 45 Min.

with Nicholson Steam Traps

Records of a recent installation of Nicholson steam traps, by a large processor, show they cut kettle time 30%; e.g., one operation was shortened from 65 to 45 min. Nicholson units keep equipment full of live steam because: 1) they operate on lowest temperature differential; 2) have 2 to 6 times average drainage capacity. Also record low for steam waste; and maximum air-venting capacity. Widely specified for preventing damage to thin gauges; eliminate cold blow in unit heaters.







5 TYPES FOR EVERY PURPOSE—SIZE ¼" to 2"; pressures to 250 lbs. BULLETIN 853.

HIGH-PRESSURE FLOATS—Stainless, monel, steel or plated steel. Welded. In all sizes and shapes; for operating mechanisms and as tanks or vessels. BULLETIN 753.

208 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

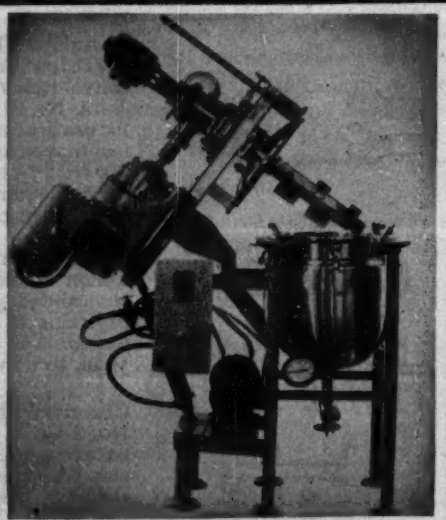
TRAPS · VALVES · FLOATS

EPPENBACH EQUIPMENT

MIXING AND HOMOGENIZING EQUIPMENT FOR VACUUM OR PRESSURE OPERATION WITH THE

EPPENBACH "AGI MIXER"

Affording advantages of paddle mixing and high speed homogenizing in one compact installation.



The "Agi" mixer produces uniform, finely homogenized blends in a fraction of the time required by conventional mixers because it combines all the desirable features of horizontally rotating, double motion paddles fitted with scraper blades with the Eppenbach high speed, high shear Homo-Mixer. The Agi mixer is designed so that the paddles may be operated either separately from, or in conjunction with the Homo-Mixer—the complete mixing assembly being installed in a jacketed kettle which can be operated atmospherically, under vacuum, or under pressure. The unit is adaptable to any required set of processing conditions and furnished complete for immediate operation. *Write for Circular 403 and additional information.*

MANUFACTURED IN ANY STYLE OR SIZE TO FIT YOUR REQUIREMENTS

ADMIRAL TOOL & DIE CO., INC.

45-10 VERNON BLVD., LONG ISLAND CITY 1, NEW YORK

NAMES IN THE NEWS, *cont. . .*

E. Ashley, personnel manager; and **Dewey Blackwood,** safety engineer. Mr. Van Zandt joined Lion Oil in 1938 and became production manager in 1942 and later assistant superintendent of Lion's chemical plant at El Dorado.

George Granger Brown. Treasurer, American Institute of Chemical Engineers. Dr. Brown, dean of the college of engineering and Edward DeMille Campbell, University Professor of Engineering at the University of Michigan, is a former president of A.I.Ch.E. and an active consulting engineer.

G. G. Brown

Jan Oostermeyer

Jan Oostermeyer. Director of Food Machinery and Chemical Corp. and of Fluor Corp. Ltd., of Los Angeles. Mr. Oostermeyer, a leading authority in the petrochemical field, was formerly president of Shell Chemical Corp.

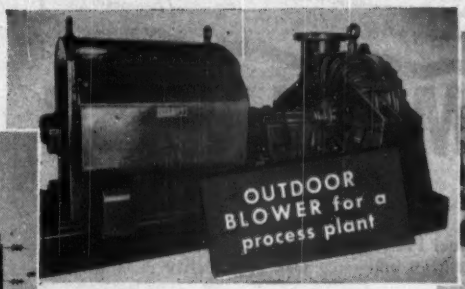
Eric G. Peterson. Executive vice president, Peabody Engineering Corp., New York, N. Y. With company since 1928, his new assignment embraces all phases of research and engineering, production and sales.

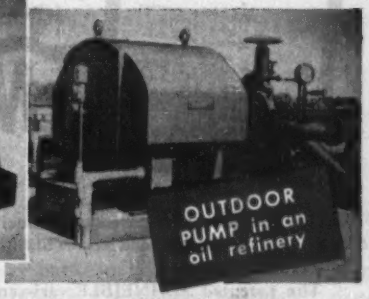
H. H. Gorrie. Chief engineer, Bailey Meter Co. With company since 1927 and assistant chief engineer since 1944.

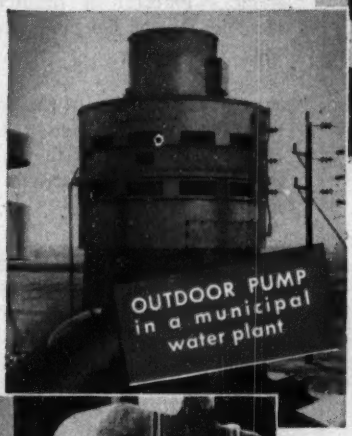
F. L. Whitney. Chief engineer, Walter Kidde Constructors, Inc. Formerly eastern district chief engineer for The H. K. Ferguson Co. in charge of design for industrial projects, and previously with B. F. Goodrich Co.'s engineering dept.

A. W. Plier. President and general manager, D. J. Murray Manufacturing Co., succeeding **F. C. Boyce,** now chairman of the Board of the company. Mr. Plier, formerly with Falls Manufacturing Co., joined

Put them outdoors...







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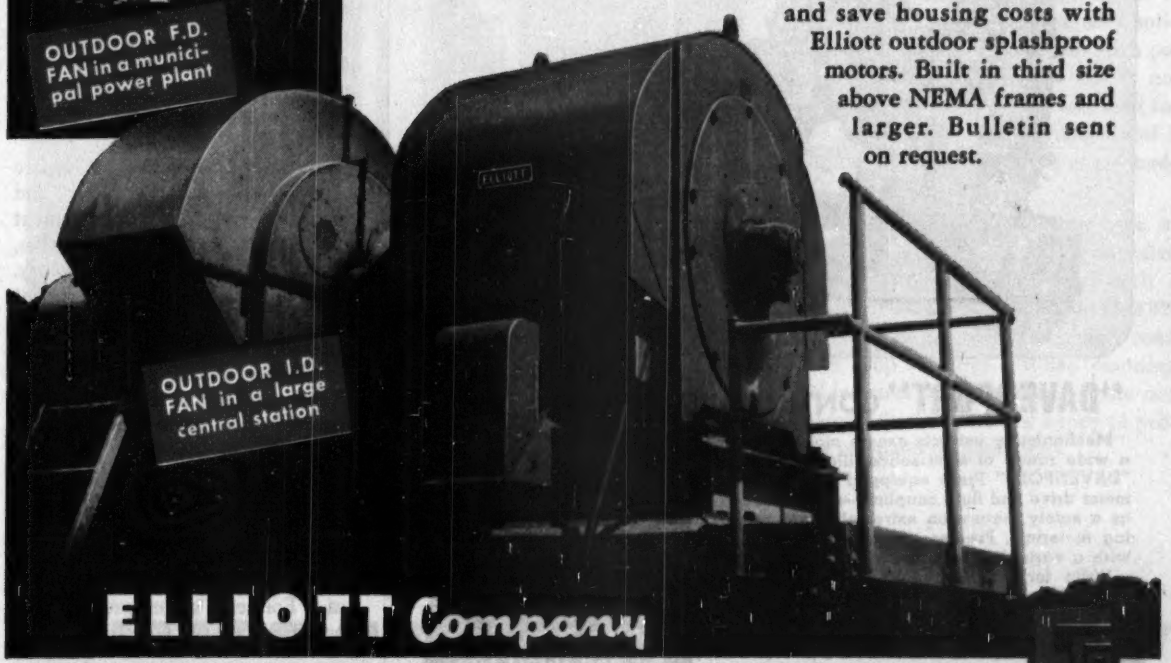

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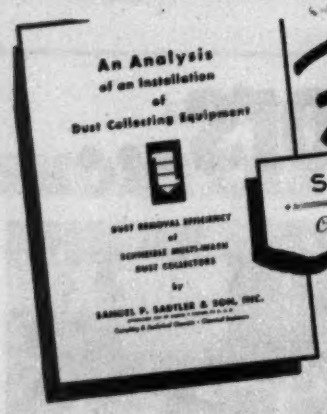

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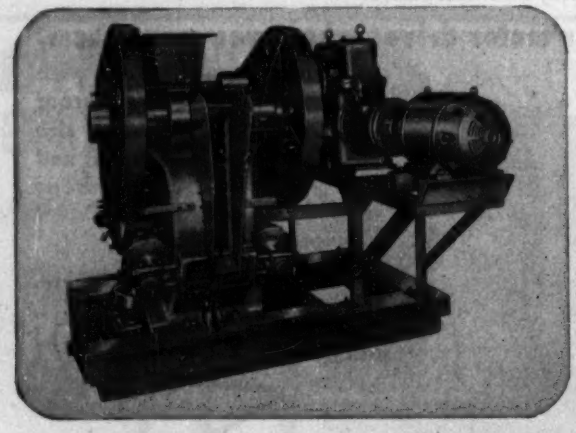

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Murray's production dept. in 1930, named secretary in 1944, elected a director in 1948 and executive vice president and general manager in 1950.

Emil Ott. President of the American section, Societe de Chimie Industrielle. Director of research for Hercules Powder Co., Wilmington, since 1939.

August Ryer. Manager of the production division of Schering Corp., Bloomfield, N. J. With the company since 1940. Doctorate from Brooklyn Polytech.

G. B. Webb. Senior process engineer for Walter Kidde Nuclear Laboratories. Has been senior process engineer for Foster Wheeler Corp. for the past two years. Worked on basic design and engineering problems in connection with the gaseous diffusion plant in Oak Ridge, Tenn., as chemical engineer for the Kellex Corp. Continued in isotope separation work with Hydrocarbon Research, Inc., on the design of a deuterium separation plant.

Herman Mark. To receive the 1953 Honor Scroll of the New York chapter of the American Institute of Chemists. Head of the division of polymer chemistry, Polytechnic Institute of Brooklyn.

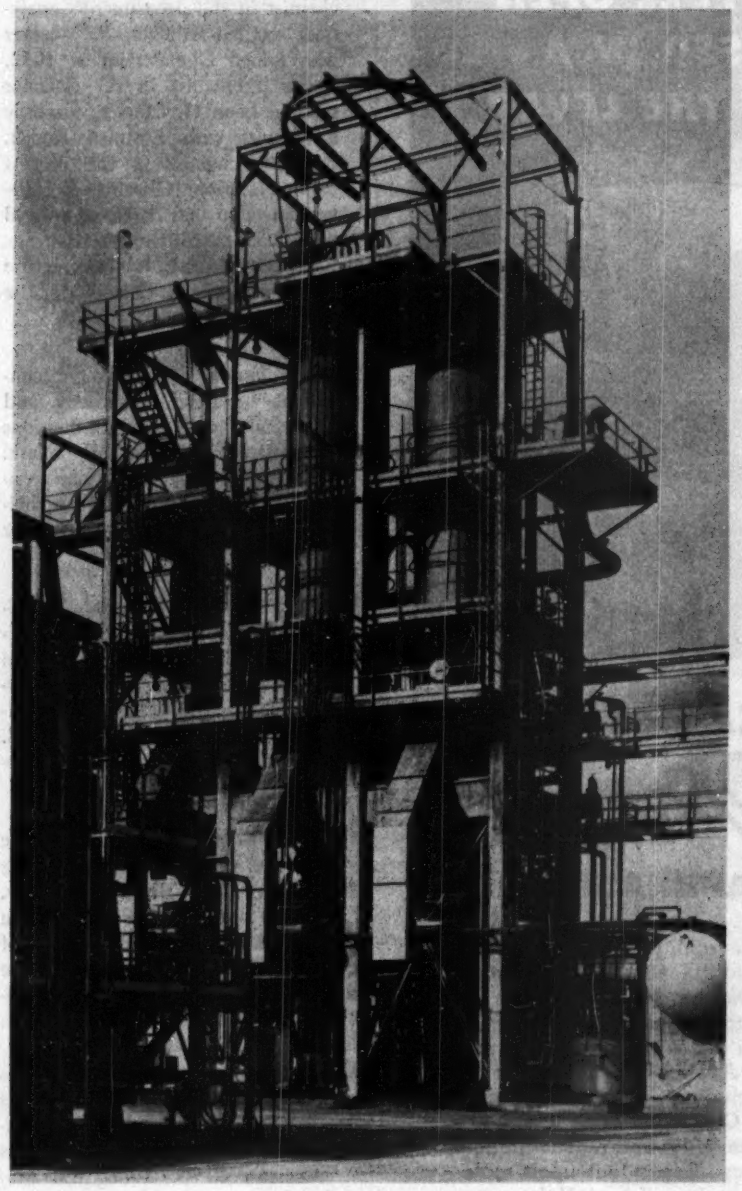
Herbert B. Gausebeck. Associate manager of the chemistry and chemical engineering department at Armour Research Foundation, Illinois Institute of Technology. Has served as assistant department chairman since 1949. Joined the foundation in 1948 as supervisor of its plastics section. Previously with Heyden Chemical Corp. as supervisor of plasticizer research.

R. S. Dicks. To help direct the process engineering section in a study of the productivity of chemical processing equipment in the textile division plants of Celanese Corp. of America. Formerly senior process engineer for Shell Oil Co.

C. John Setzer. Research chemical engineer in the general process section, research and development department of Chemstrand Corp.

STAINLESS STEEL VESSELS

for Phosphoric Acid Plant in Scotland



View of phosphoric acid plant at the Grangemouth refinery showing the two stainless steel reactors and the catch pot built by Chicago Bridge & Iron Company.

One of the most up-to-date petroleum refineries in the world is located midway between Edinburgh and Glasgow, Scotland. Completely remodeled since the war at a cost of about $42,000,000, it now has a crude charging capacity of 50,000 bbls. per day and produces motor gasolines, kerosene, gas-oil, fuel-oil, etc.

The illustration at the left shows two 9-ft. 3-in. diam. by 38-ft. phosphoric reactors and an 8-ft. 6-in. diam. by 22-ft. catch pot that we built in our Birmingham, Alabama plant and shipped to the Grangemouth refinery. These vessels are built of ASTM-A-240 Grade M, Type 316, modified stainless steel. The 30-in. flanged and dished heads on top of the reactors are made of A-285 Grade C, firebox steel and are lined with solid nickel. The dome head of the catch pot is made of the same steel but is not lined. Several other alloys were used for fittings and piping connections and a number of internal grid plates are made of solid nickel.

These vessels illustrate the type of structures we build for corrosion-resistant service. The handling of such a variety of alloys calls for production experience, skilled personnel, and complete shop facilities. When planning welded steel plate structures, write our nearest office. We will be happy to provide estimates or quotations.

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Havana.....402 Abreu Bldg.
Houston 2.....2103 C & I Bldg.
Los Angeles 17..1505 General Petroleum Bldg.
New York 6.....3318—165 Broadway Bldg.
Philadelphia 3...1625—1700 Walnut St. Bldg.
Pittsburgh 19.....3205 Alcoa Bldg.
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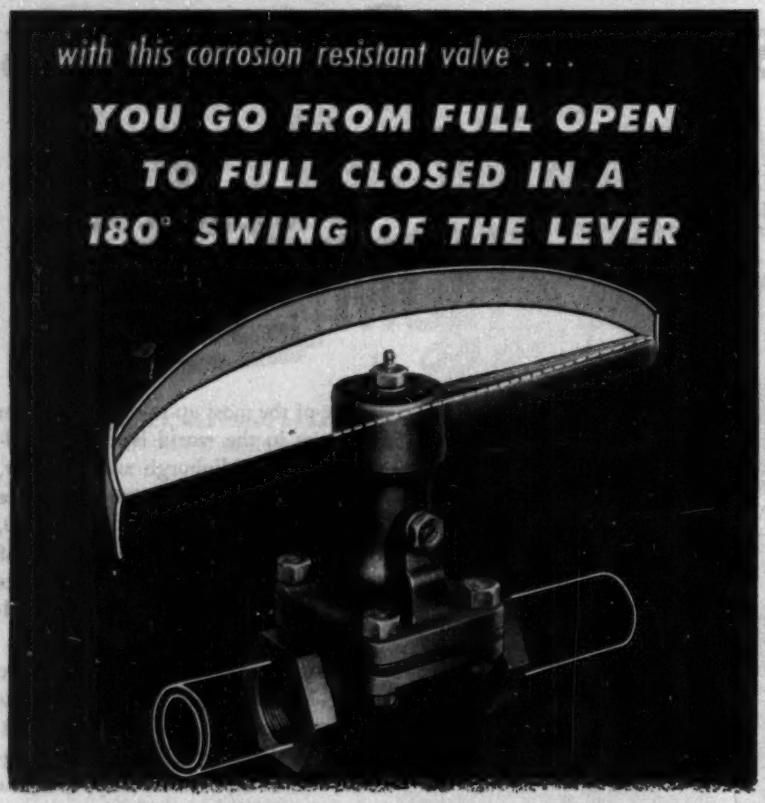
Seattle 1.....1305 Henry Bldg.
Tulsa 3.....1623 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA



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NAMES IN THE NEWS, cont. . .

Doctorate in chemical engineering from Ohio State. New research chemist in the department's analytical section: **William S. Wagner** who joined Chemstrand in 1952. Research chemist in the polymer section: **Leon H. Chance,** formerly a chemist with Eastman Kodak. Research chemist in the process organic section: **Clarence E. Hieserman** who has been associated with Celanese for the past 10 years. Research chemist: **John Lomartire** who has been with Celanese for the past nine years.

Franklin Farley. Management consultant to Food Machinery and Chemical Corp.'s chemical divisions administrative staff in New York. For the past twelve years, vice president in charge of the phosphate division of International Minerals & Chemical Corp., Chicago.

Procter Thomson. President, American Oil Chemists' Society. Associate director in charge of process standards, chemical division, Proctor and Gamble. New vice president of the society: **Charles E. Morris,** production manager, refinery, Armour and Co., Chicago.

G. W. Wilson. Section head in the technical service of Humble Oil & Refining Co.'s Baytown refinery. For the past two years has been a specialist in design and operation of fractionating towers. Joined the company in 1935. Chemical engineering graduate of Rice Institute.

C. D. Burton. Industrial relations manager, chemical division, Koppers Co. Has been manager of the division's plant at Petrolia, Pa. His successor: **C. G. Youngquist** who for the past two years has been manager of the Oil City, Pa., plant.

E. H. Hungerford. Director of research and chemical control for the Great Western Sugar Co.

H. O. Kaufman. Technical director, Buffalo Electro-Chemical Co. Formerly research director. New personnel in the research and development department: **E. S. Shanley,** assistant technical director and manager of inorganic and physical chemical research; **P. H. Margulies,**

technical information and patents; **L. H. Dawsey,** manager of process research; **F. P. Greenspan,** manager of organic research and development; **R. L. McEwen,** manager of pulp and paper research and development, and **B. K. Easton,** supervisor of textile research and development.

DeWitt O. Myatt. Manager of development, Atlantic Research Corp., Alexandria, Va. Has been managing editor of ACS *Industrial and Engineering Chemistry* for seven years. Prior to that, with TVA's Muscle Shoals, Ala., fertilizer plants and laboratories. Studied at Speed Scientific School of the U. of Louisville.

Vance O. Bonnichsen. Group leader in the supervision of chemical intermediates area, the Chemstrand Corp.'s nylon plant near Pensacola. Formerly in central engineering section since joining the company in July 1951. Studied at Iowa State College and Texas A & M

John R. McVeigh. Chief engineer and Engineering executive, Armed Services research & development projects, Alloy Engineering & Casting Co., Champaign, Ill. Has been research engineer for Kennametal, Inc. and project engineer for Continental Aviation & Engineering Corp.

John M. Lenoir. Chairman, University of Denver chemical engineering department. Formerly on the University of Arkansas faculty. Has been pilot plant development engineer for Westvaco Chlorine Products Corp. and Pan-American Refining Corp. Studied at the U. of Illinois and the U. of Iowa.

Robert F. Meehan. Chemical engineer in Monsanto Chemical Co.'s phosphate division. Formerly section chief in the operations division at Mound Lab., AEC installation operated by Monsanto at Miamisburg, Ohio. Joined company as research chemist in 1943. RPI graduate.

F. R. Keller. Assistant chief plant engineer, American Cyanamid Co.'s new plant near New Orleans, La. Has served with the company's industrial chemicals division, engi-

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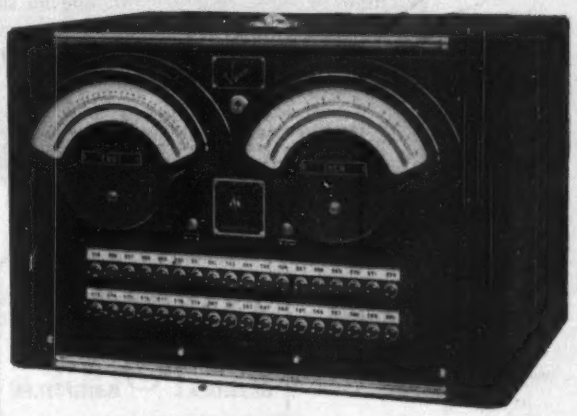

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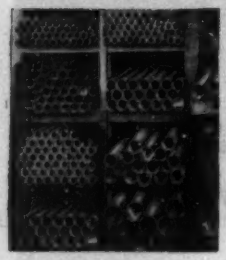

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neering dept., and most recently the atomic energy division's Idaho Falls, Idaho, plant. Graduate of Syracuse University, Senior mechanical engineer of the new plant: **T. S. Button.** Formerly senior chemical engineer at Cyanamid's Wallingford, Conn., plant. Studied at U. of Maine, the U. S. Military Academy at West Point, and the U. of Pennsylvania. Utilities superintendent of new plant: **L. T. Loughridge.** Formerly plant power engineer with American Smelting and Refining Co. Graduate of Montana State College.

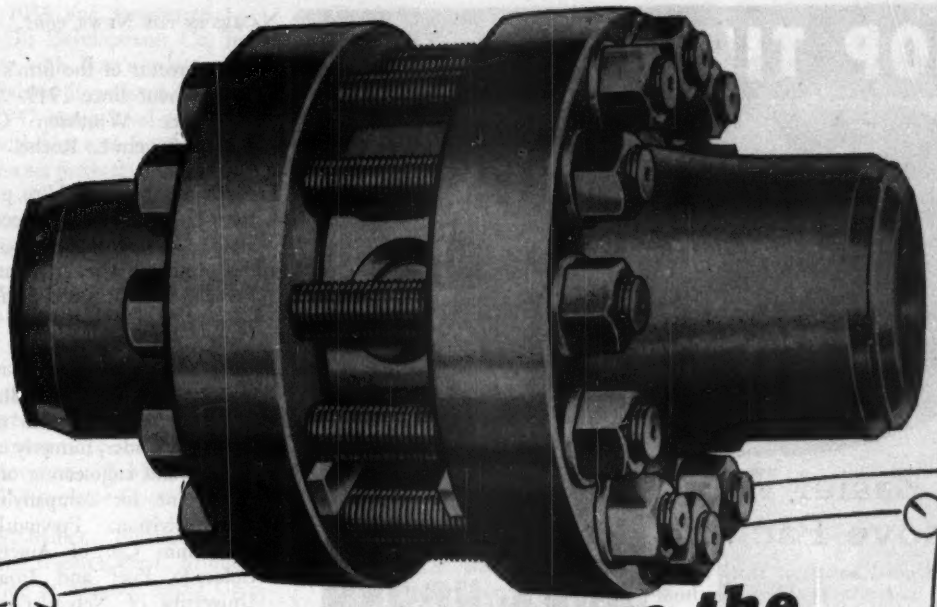
W. K. Belin. Maintenance superintendent of Monsanto Chemical Co.'s Trenton, Mich., plant. Has been production superintendent at Trenton since 1950 and acting plant manager since January 1953. Joined company in 1941. Graduate of U. of Minnesota. Production superintendent: **C. P. Cunningham.** Formerly at company's division research laboratory in Anniston, Ala. Transferred to Trenton plant in 1946 and became production supervisor in 1952. Graduate of U. of Alabama.

Peter Hosler. Biochemist in the antibiotics manufacturing and development division of Eli Lilly & Co. Graduate of Case Institute of Technology and U. of Wisconsin.

Leo Brewer. Recipient of 1953 Leo Hendrik Baekeland Award of ACS North Jersey Section. Associate professor of chemistry at University of California radiation laboratory. Also recipient of Great Western Dow Fellowship for 1942-43 and the Guggenheim Fellowship for study in Europe in 1950-51. Graduate of California Institute of Technology and University of California.

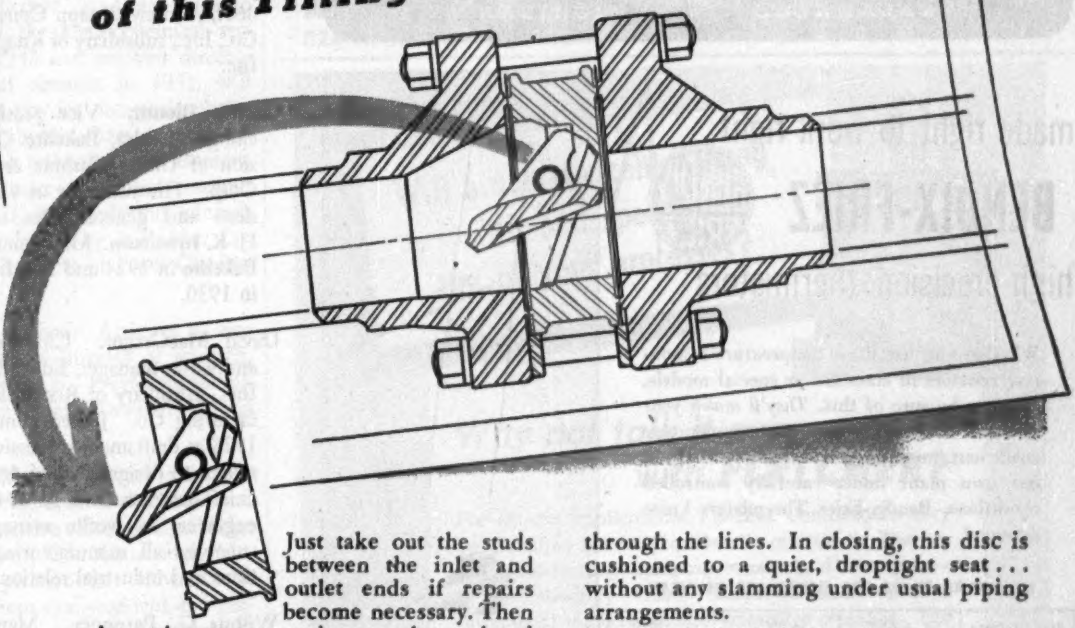
John Staley. Project director, product and market sales development department, Reynolds Metals Co., Louisville, Ky. Has been in charge of the mechanical process development laboratory for the General Electric chemical division. Chemical engineering graduate of Purdue.

Clarence B. Taft. Vice president in charge of product development, Schenley Laboratories, Inc. Has



You Can Remove the Center Section

of this Tilting Disc Check Valve



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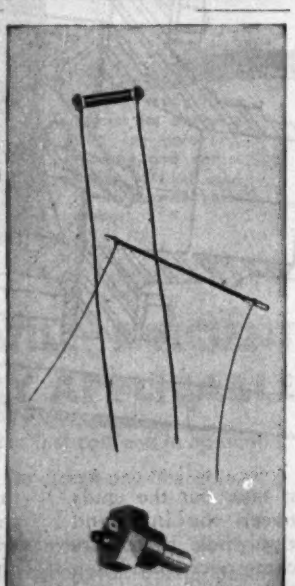

Used in this typical application for sensing the temperature of hydraulic oil.

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been director of the firm's product development since 1949. Previous employers: Winthrop Chemical Co.; Hoffmann-La Roche.

Frederic W. Mellor. Vice president, John J. Harte Co., engineers of Atlanta, Ga. Has been assistant to the president, the Foundation Co. Previous to that, general sales manager, H. K. Ferguson Co.

Charles F. Hauck. Sales manager, chemical plants division, Blaw-Knox Co. New assistant sales manager: **Bruce Alexander,** formerly in charge of sales and engineering of process equipment for company's equipment division. Previously with Aluminum Co. of America and Colorado Fuel and Iron Corp. University of Nebraska graduate. Mr. Hauck joined Blaw-Knox in 1951 as manager of sales promotion of chemical plants division and later was assistant sales manager of the division.

Harold E. Olson. Executive vice president, Andrews-Knapp Construction Co., Inc., subsidiary of Knapp Mills, Inc.

C. W. Blount. Vice president in charge of sales, Bakelite Co., division of Union Carbide & Carbon Corp. His successor as vice president and general sales manager: **H. K. Intemann.** Mr. Blount joined Bakelite in 1924 and Mr. Intemann in 1930.

David MacGregor. Chief engineer and works manager, Edward Valves, Inc., subsidiary of Rockwell Manufacturing Co. Joined company in 1925 as draftsman; successively promoted to designer, chief draftsman, chief designer, and in 1943 chief engineer; as works manager will supervise all manufacturing operations and industrial relations.

Wilbur G. Perriguey. Manager of sales engineering division, Esso Standard Oil Co. His successor as assistant manager: **Wilbur J. Reitze.** Mr. Perriguey joined Esso in 1944 as senior engineer on automotive fuels and lubricants and later headed the engineering group in this field; since 1950 has been assistant manager of sales engineering. Mr. Reitze joined Esso's Baltimore re-

finery in 1934 and transferred to Standard Oil Development Co. in 1937; later with Esso's sales engineering division in railroad lubrication; in 1947 group head of metal working activities and later section head of process products and metals. Founder and present chairman of metal working lubricants committee of American Ordnance Association.

Jerome Ottmar. Vice president, Metals & Controls Corp., Attleboro, Mass. Formerly manager of engineering and sales in company's general plate division and sales promotion manager for Spencer thermostat division. With company since 1938, and previously associated with Minneapolis-Honeywell Regulator Co.

Matthew W. Miller. Business manager, central research dept., Minnesota Mining & Manufacturing Co. New associate directors of central research dept.: **Alvin M. Borders** and **Harold M. Scholberg.** Dr. Miller, formerly assistant director of the dept., joined the company as a research chemist in 1947. Dr. Scholberg, who joined the company as a senior chemist in 1944, became leader of the electrochemical section in 1948 and assistant director of central research in 1951, will head the physics, inorganic chemistry and physical chemistry sections of central research. Dr. Borders, section leader of central research since 1951, previously did research with Goodyear Tire & Rubber Co. and the Institute of Paper Chemistry.

William J. Mahan. Assistant to vice president and director of research, Kraft Foods Co. Previously technical director for Diamond Crystal Salt Co.

Clarence Edward Pink. From president to chairman of the board and chief executive officer of Cambridge Wire Cloth Co., Cambridge, Md. Other promotions: **Edward N. Evans,** from vice president and general manager to president; **Irwin F. Pink,** from executive vice president to senior vice president; **Fred L. Hooper,** from assistant to the president to executive vice president.

Edwin Frederic Pike. Director of chemical engineering dept., Giffels & Vallet, Inc. L. Rossetti, associated engineers and architects of Detroit. —*End*

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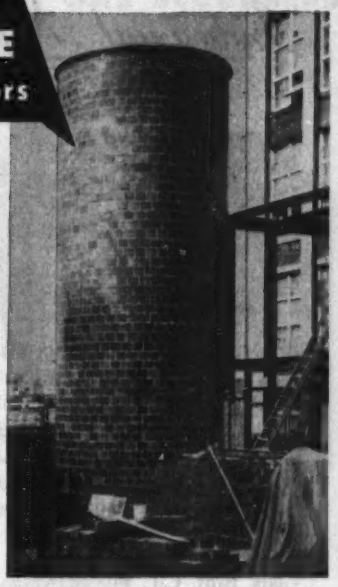

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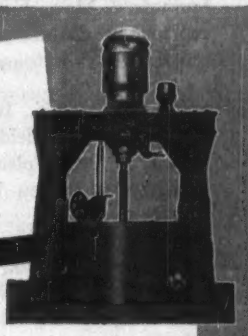

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Industrial Notes

NEW FACILITIES

Wallace & Tiernan Ltd. of Canada—A manufacturing plant and head office outside of Toronto will serve as headquarters for its operations including chlorine and chemical control equipment, precision instruments and flour treatment service.

Clark Bros. Co., Olean, N. Y.—New district office in Kansas City, Mo. The firm is a manufacturer of engines, compressors and turbines.

Monsanto Chemical Co.—Third expansion of its phenolic resin production line at Port Plastics, Ohio, and higher capacity equipment at Springfield, Mass. due to recent acceptance of phenolic resins for shell molding in the foundry industry.

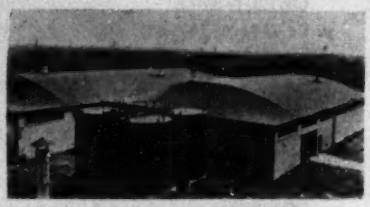
Hercules Powder Co., Inc.—Plant expansion at Mansfield, Mass., designed to boost plant output of pentaerythritol from 18 to 24 million lb. a year.

Kawecki Chemical Co., Inc., Boyertown, Pa.—opened New York offices. High purity selenium, ferroselenium, and a number of double fluoride compounds are produced by the firm.

College of Forestry, State Univ. of N. Y.—Plans $3 million Wood Products Laboratory Building to be devoted to instruction and research on forest products. The four-story structure, containing more than 96,000 sq. ft. of floor space, will include such special facilities as laboratories with controlled temperature and humidity.

Cleaver-Brooks Co.—Addition to its main plant in Milwaukee provides increased production facilities to handle the firm's expanded sales.

General Chemical Division, Allied Chemical & Dye Corp.—Sulfuric acid plant at Painesville, Ohio, marks the second major expansion of its facilities. The plant, which will produce acid by the contact process, will serve expanding acid needs of steel and rayon producers in that area.



Witco Chemical Co.—A 25,000 sq. ft. warehouse at the Chicago plant attached to new executive offices. Built at a cost of $150,000 the new building is completely equipped with a springler system to guard against a recurrence of last year's fire.

Diamond Alkali Co.—Centralized storage-and-handling facilities at the Jersey City silicate plant to increase service to consumers of their chemicals in the area.

Hercules Powder Co.'s synthetics department—A St. Louis, Mo., sales office managed by John S. Autenrieth.

Raybestos-Manhattan, Inc., Passaic, N. J.—A rubber roll covering plant for its subsidiary, the Manhattan Rubber Mfg. Co. at Neenah, Wis.

Northeastern Chemical Corp., Westbrook, Me.—A process plant for herbicides and fungicides. It has an estimated capacity of 20 tons a day of dry product and 5,000 gal. a day of liquid.

Engineering Research Associates, St. Paul—Additional space for expanded electronic computer and precision instrument development and production.

Bridgeport Brass Co., Bridgeport, Conn.—A Louisville, Ky., warehouse to carry stocks of brass, copper and bronze in strip, rod, wire and tube.

Enthone, Inc., New Haven, Conn.—Increased manufacturing and warehousing facilities, in the form of a two-story addition to their plant, for stocking of Enthone compounds and for new research and development and customer service laboratories.

NEW NAMES

The Kold-Hold Mfg. Co., Lansing, Mich., has changed its corporate name to Tranter Mfg. Inc. The firm is a manufacturer of refrigeration equipment and products in the industrial heating field.

Taco-West Corp., Chicago, manufacturers of precision temperature controllers, will now be known as the West Instrument Corp.

Saxonburg Potteries, serving the radio, electronic and appliance industry, and resistor manufacturers with precision ceramics, will now be designated as Saxonburg Ceramics.

NEW SERVICES

Dechema House, Frankfurt, Germany, has established a new information center to gather and display all forms of chemical apparatus and equipment.

NEW COMPANIES

Instrument Center—New representative organization to handle scientific instruments, components and accessories in New York City.

Empire Chemical & Supply Co., Inc., Mission Tex., owned jointly by Hayes-Sammons Chemical Co. and Charles F. Lunsford will lease part

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of the Hayes-Sammons production facilities to turn out agricultural and industrial chemicals and fertilizers.

Rubarite Inc. to manufacture and sell synthetic rubber powders for use in asphalt for roads and in other asphalt materials for its joint owners, the Goodyear Tire & Rubber Co., the National Lead Co. and the Berry Asphalt Co., Chicago.

Eutectic Welding Alloys Co. of Canada, Ltd., to manufacture low temperature welding alloys to meet Canadian demands on the parent company, Eutectic Welding Alloys Corp., New York.

Pacific Adhesives Co., a plywood glue company, has been organized by Charles N. Cone—former manager of the glue division of U.S. Plywood Corp.

NEW LINES

Continental Can Co., Inc.—Flexible packaging business through purchase of Shellmar Products Corp.'s Flexible Division. Shellmar is a leading converter of cellophane, polyethylene, pliofilm, acetate, foil, and various laminated and coated products. The transaction does not include Shellmar's Self-Locking Division.

Chemical Applied Research, Inc.—An independent laboratory to place at the disposal of industry scientists working with the newest technical equipment.

Warren Petroleum Corp., Tulsa, Okla., will enter the petrochemical field upon the establishment of a plant at the corporation's Warrengas terminal.

Laclede-Christy Co.—Vitrified clay sewer pipe through the acquisition of plant properties of the Whitehall Sewer Pipe and Stoneware Co., at Whitehall, Ill.

Joshua Hindle & Sons Ltd., Leeds, Eng.—Blind valves to be manufactured and marketed in England. The firm enters the field as the result of an agreement with the Hamer Oil Tool Co., Long Beach, California.

NEW REPRESENTATIVES

Kieley and Mueller, Inc., North Bergen, N. J., manufacturer of diaphragm control valves, has appointed the Steam Plant Equipment Co. of Milwaukee, Wis., as its representative in sections of Wisconsin and Michigan.

R-C Scientific Instrument Co., manufacturer of radioactivity laboratory counting instruments, has appointed the Atomic Center for Instruments & Equipment, Inc., New York, as its eastern sales agent.

Hammel-Dahl Co., Providence, R. I., manufacturers of automatic control equipment, has appointed C. W. Dean and Associates, Memphis, Tenn., as sales and service representatives.

M. W. Kellogg Co., Jersey City, N. J., has appointed the Flek Corp., Los Angeles, as its exclusive warehousing distributor for Kel-F molding powders on the West Coast.

Insul-Mastic Corp. of America, Pittsburgh, Pa., has licensed Knudsen Co., Syracuse, N. Y., to sell and apply Insul-Mastic protective coatings.

Terry Steam Turbine Co. has appointed the Hank Thurstin Co., Denver, Colo., to handle the sale of its turbines in Colorado, Wyoming, western Nebraska and northern New Mexico.

Warren Steam Pump Co., Warren, Mass., manufacturer of a complete line of centrifugal, reciprocating and rotary pumps, has appointed Wilcox Engineering Co., Cincinnati, as area representatives.

Kessler Chemical Co., Philadelphia, has appointed R. E. Flatow & Co., San Francisco, as its agents in that area.

Visking Corp., Terre Haute, Ind., has appointed the Flek Corp., Los Angeles, as its distributor for its extruded layflat tubing made from fluorochlorocarbon resins.

Reflin Co., Gardena, Calif., has appointed Republic Supply Co. of California as distributor for its glass-fiber-reinforced plastic pipe.

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These basic chemicals aid removal and recovery of acidic gases . . . also serve as intermediates for emulsifiers and detergents

Few organic chemicals have found such diversified application as the ethanolamines. From the purification of gas streams and the recovery of hydrogen sulfide for conversion to sulfur, to the production of detergents, these basic chemicals have performed many vital services . . . may well aid your process or product, too. To assist you in realizing full value from the ethanolamines, Dow offers you the following information, including precautions in use and handling:

USES OF ETHANOLAMINES—GAS TREATMENT. Monoethanolamine is used in removing carbon dioxide and hydrogen sulfide from gas streams. Then, the hydrogen sulfide may be selectively burned to produce sulfur.

A certain amount of carbon dioxide is formed, when methane is burned to produce carbon monoxide and water in the manufacture of methanol. This carbon dioxide, which would interfere with later operations, is removed with monoethanolamine.

Methane is scrubbed with monoethanolamine prior to making carbon black. This scrubbing removes any hydrogen sulfide which would subsequently be converted to sulfur and contaminate the carbon black.

Diethanolamine is used in much the same manner as previously described for monoethanolamine. However, diethanolamine may be used in cracking gases and coal or oil gases which contain carbonyl sulfide that would react with monoethanolamine.

SURFACE ACTIVE AGENTS. Monoethanolamine and triethanolamine may be reacted with alkyl aryl sulfonates, fatty alcohol sulfates or fatty acids to produce surfactants that serve in detergents, soaps, shampoos and various cleaning compounds. To this date, the largest single use is in the production of a moderate duty household detergent.

Diethanolamine is used extensively in the production of lubricants for the textile industry. These lubricants can be easily removed by the use of a detergent. Also, diethanolamine is used in detergents, soaps and cleaning compounds.

CLEANING AND POLISHING COMPOUNDS. Triethanolamine is used in the manufacture of cleaners and polishes for metals, wood, leather, floors, and furniture. Triethanolamine soaps act as emulsifiers and dispersing agents in these applications. Triethanolamine is also used in automobile polishing, cleaning and degreasing compounds. It is used in emulsion stabilizers and dispersing agents for waxes and industrial lubricants.

MISCELLANEOUS USES. Monoethanolamine is reacted with other chemicals to produce an accelerator which has greatly reduced the time required for producing penicillin. Monoethanolamine is also used in a variety of other products such as wax removal compounds.

Diethanolamine is used as an emulsifier and dispersing agent in various agricultural chemicals, cosmetics and pharmaceuticals.

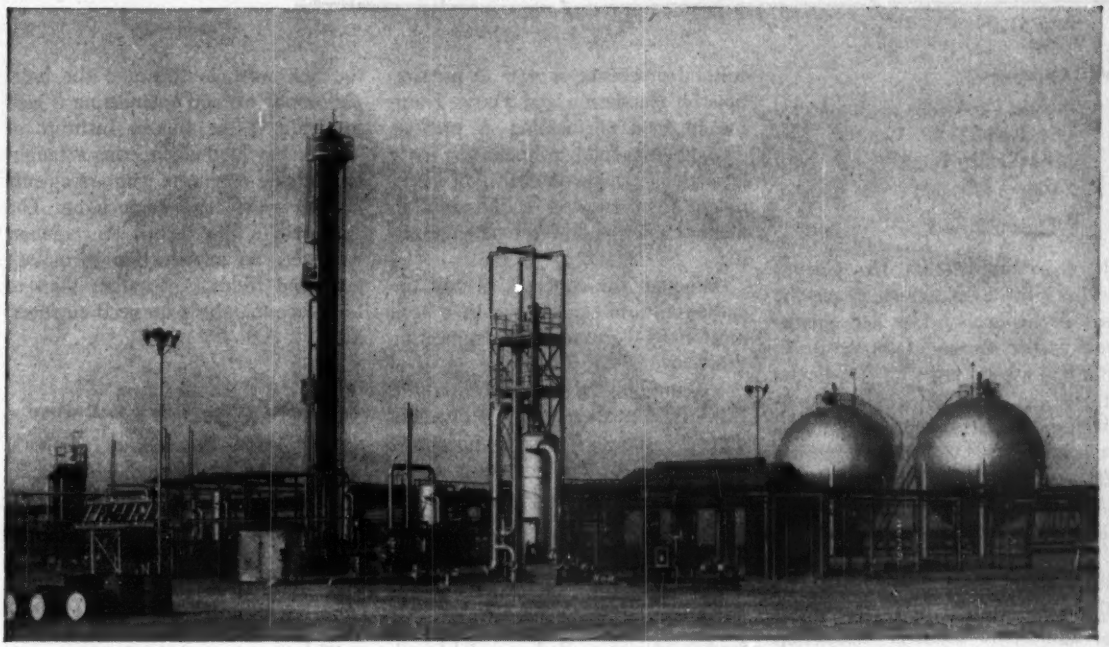
PRECAUTIONARY MEASURES. The ethanolamines do not present an appreciable fire hazard. Monoethanolamine has the lowest flash point of the three (195°F.) and should not normally present a hazard except in cases of large leaks or spills.

The ethanolamines present no unusual toxicity hazards. Monoethanolamine may cause skin irritation in concentrations greater than 1% and contact should be avoided as much as possible. Diethanolamine is markedly irritating in concentrations greater than 10%. Triethanolamine is not seriously irritating if diluted and will probably cause no serious difficulty unless prolonged or repeated exposures are encountered.

Strict precautions should be observed whenever there is a possibility of eye contamination with an ethanolamine. All persons should wear face shields, goggles with side shields, or the equivalent. Suitable facilities for washing the eyes should be readily available. If contaminated, the eyes should be washed with large amounts of flowing water and medical aid should be summoned.

If an ethanolamine is spilled on the person, all contaminated clothing should be removed and not worn again until decontaminated. The exposed area should be washed with flowing water and medical aid should be summoned for victims of prolonged exposure.

For further information write to THE DOW CHEMICAL COMPANY, Midland, Michigan.



PROPERTIES OF DOW ETHANOLAMINES

	Monoethanolamine	Diethanolamine	Triethanolamine
Molecular Weight	61.1	105.1	149.2
Boiling range	169.3-171.7°C.	166.6-169.4°C.	189.3-192.2°C.
	5-95% at 760 mm. Hg	5-95% at 20 mm. Hg	10-95% at 5 mm. Hg
Freezing point	10.3°C.	25.1°C.	17.9°C.
Specific gravity at 25/4°C.	1.0113	1.0881 (30/4°C.)	1.1179
Specific gravity at 60/4°C.	0.9844	1.0693	1.0985
Pounds per gallon at 25°C.	8.45	9.09 (30°C.)	9.34
Refractive index at 25°C.	1.453	1.475 (30°C.)	1.484
Viscosity at 25°C., centipoises	18.95	351.9 (30°C.)	590.5
Viscosity at 60°C., centipoises	5.03	53.85	65.65
Flash point (Cleveland Open Cup)	195°F.	300°F.	365°F.
Fire point (Cleveland Open Cup)	200°F.	330°F.	410°F.

NOTE: Properties have been determined on material believed to be representative of current Dow production.

SOLUBILITY OF ETHANOLAMINES

(grams per 100 grams solvent at 25°C.)

	Monoethanolamine	Diethanolamine	Triethanolamine
Acetone	∞	∞	∞
Benzene	1.4	0.3	4.2
Carbon Tetrachloride	0.2	<0.1	0.4
Ether	2.1	0.8	1.6
n-Heptane	<0.1	<0.1	<0.1
Methanol	∞	∞	∞
Water	∞	∞	∞

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Chemical Engineer's Bookshelf

Edited by Lester B. Pope

New Approach

IONIC PROCESSES IN SOLUTION. By Ronald W. Gurney. McGraw-Hill Book Co., New York. 275 pages. $6.50.

Reviewed by F. C. Nachod

It is a tragedy that Dr. Gurney could not live long enough to see the fruits of his work. He died prematurely at the age of 54 on April 15, just a few weeks before his book came out.

His text is a new approach to electrochemistry in which the author makes extensive use of statistical mechanics. It is primarily addressed to research workers, students and teachers in the field of electrochemistry, and problems at the ends of chapters will make it attractive to the latter. The admittedly arbitrary distinction on the part of the author that ions in gases are rightfully part of physics while ions in solution are classed as chemistry will come as a surprise to some readers. However they, too, will admit that the author has done well with the chemical side of the problem.

For Engineers

ELEMENTS OF FOOD ENGINEERING, Vol. I. By Milton E. Parker, Ellery H. Harvey and E. S. Stateler. Reinhold Publishing Corp., New York. 386 pages. $8.75.

Reviewed by M. A. Joslyn

The general need for adequate training in food engineering and the need for an authoritative text and reference work in the field have long been recognized. Farrall's "Dairy Engineering," first published in 1942 and now in its second edition probably was the first introductory text in this field and the principles of dairy products processing operations have long been included in curricula in dairy industry.

The unit operations in processing of agricultural products also have been included in curricula in agricultural engineering and an introductory text to the engineering elements of agricultural processing is now in preparation by Henderson and Perry. Training in food engineering as such as distinct from food technology is more recent. The Illinois Institute of Technology has pioneered in the establishment of a curriculum in food engineering.

Although the concepts of unit operation and unit processing have been most fruitful in chemical engineering they have been introduced in food processing only relatively recently. Dr. L. V. Burton, then editor of *Food Industries* (now *Food Engineering*) was one of the first to clearly recognize the advantages possible in the analysis of food processing, irrespective of type of food, into the operations and processes common to all.

In this, the first of a projected three volume text and reference work on food engineering, Parker and his collaborator in the first four chapters define the field of food engineering in terms of basic unit processes involved (including both change in phase and composition) and the methods (unit operations) by which the unit processes are effected. Although these concepts differ from those used in chemical engineering they are justified on the basis of biological factors involved. The introductory material is rather too descriptive and general and does not include a discussion of the basic engineering approach. The remaining nine chapters deal with the refined food processing, i.e. cereal flours, fats and oils, sugars and sirups, protein derivatives, spices and condiments, beverages and fermented products and nuts. Each of these nine chapters deals largely with a rather brief description of the processing and such engineering evaluation as is made is largely limited to the statement that "the major unit operations involved are those of separating, cleaning, controlling," etc.

Actual analysis of the common basic operations is not made, and basic engineering data such as would be necessary for design or operation is not included. Much of the material presented is that which one would expect in a descriptive text in food technology. While this is disappointing in the first work in the field the basic philosophy of food engineering is well justified. At the Illinois Institute of Technology food engineering is taught to graduate engineers who are already familiar with basic engineering. The approach in this text is to engineers who need an introduction to biology and food technology, rather than to food technologists who need engineering.

For Industries Using Cellulose

WOOD CHEMISTRY, Vols. I and II. Second edition. By Louis E. Wise and Edwin C. Jahn. Reinhold Publishing Corp. New York. 1,343 pages. $15 per volume.

Reviewed by K. Ward, Jr.

This revision of ACS Monograph 97 furnishes the reader a thorough survey of the complex field of wood chemistry. The editor's viewpoint of wood as a complex system makes many of its properties more clearly understandable and any chemical engineer who uses wood as a structural material, as a fuel or as a chemical raw material will find valuable information in the compilation. The size and cost will be drawbacks as a textbook, but it will be a very useful reference work.

It is obviously impossible to cover in great detail the technology of the various related fields of pulp, paper and other industries built on cellulose as a material, but the reader will find excellent summaries of the fundamental principles involved, as well as references to more detailed studies of the individual processes.

The scope of the work may be indicated by a comparison with the earlier volume. The new compilation has seven sections instead of the previous six and 22 authors instead of the previous 14. Incidentally, the editors are to be commended for their successful fusion of the individual chapters into a unit. Only occasionally are the differences in individual opinions evident and there is practically no disjointedness or unevenness.

Part I—Growth, Anatomy and Physical Properties of Wood—has

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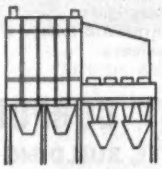

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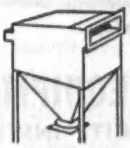

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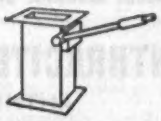

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been revised and expanded, although not as greatly as some sections. Part II—Components and Chemistry of the Cell Wall—has been brought up to date, a thorough job, which involved elimination of one chapter and considerable expansion of the others. This part covers very ably our knowledge of the fundamental chemical structure and properties of those important cell-wall constituents, cellulose, the hemicelluloses and lignin. More space is devoted to this part of the book than any other; this reflects not only the basic importance of the subject, but also the great activity of the past several years in this field. Part III—Extraneous Substances—is also tremendously expanded. The single chapter of the previous monograph has been subdivided into six.

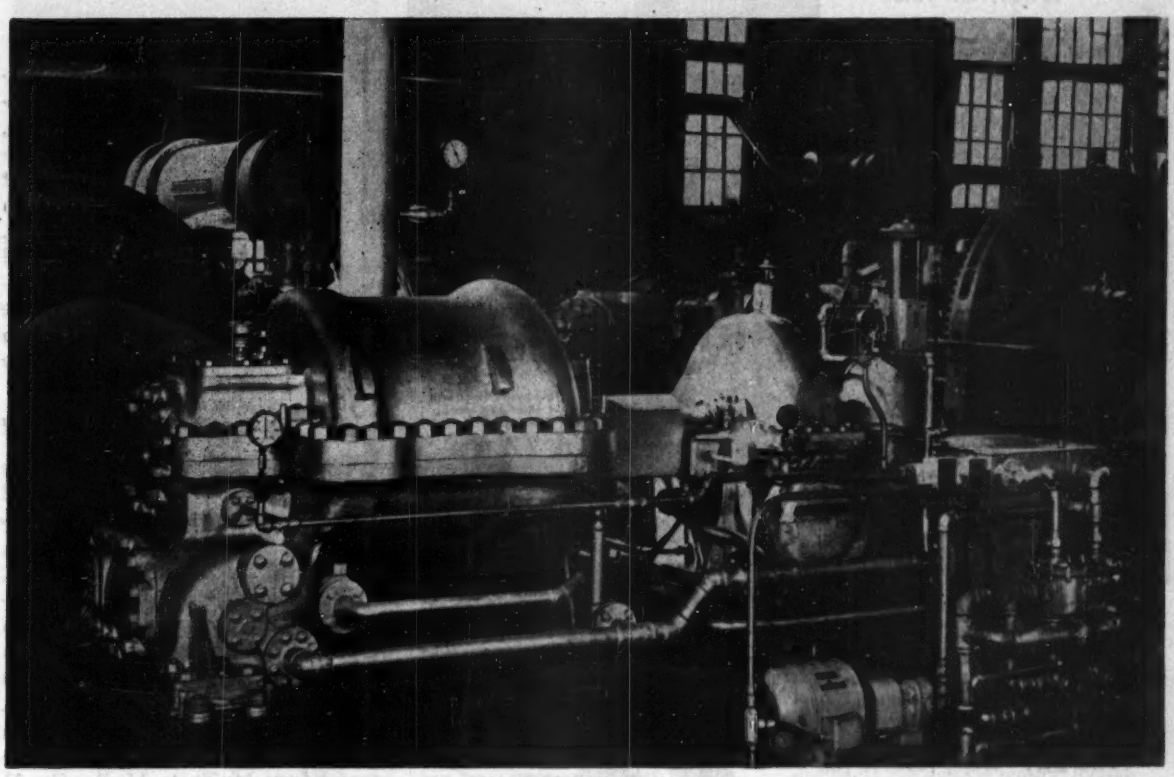
Vol. II begins with Part IV—Surface Properties of Cellulosic Materials—and consists, as in the previous edition, of a single chapter, which has been revised to include recent material up into 1952. Part V—Industrial Wood Chemistry—and Part VI—Decomposition of Wood by Micro-organisms—represent a wise separation of two loosely-related subjects in Part V of the previous edition. Part V will be of particular value to the engineer. It includes a revised chapter on the combustion of wood, a completely rewritten chapter on thermal decomposition, a new chapter giving an excellent survey of wood hydrolysis, a revised and expanded chapter on chemical behavior of wood (as distinguished from its individual components) and a group of four chapters, three on pulping and one on bleaching, to replace the single chapter on delignification in the previous edition. These chapters deal with basic principles rather than equipment and operating conditions and will be of assistance to those who wish a better understanding of what is involved in the industrial processes. Part VI has been lifted and expanded into a separate division commensurate with the importance of the subject. Finally, Part VII—Chemical Analysis of Wood—has been rearranged and rewritten to give an up-to-date critical analysis of the most satisfactory analytical methods in common use and of the significance of the data so obtained.

The form and appearance of the books are very good. Special praise is due for the preparation of tables,

centrifugal compressor

delivers more air from less space at Wyandotte Chemicals

Dwarfed by the reciprocating compressors that surround it, this centrifugal compressor solved a problem for Wyandotte Chemicals Corporation. Wyandotte needed to increase the capacity of a continuous process and greater quantities of compressed air were needed to back-blow the rotary filters. *The problem:* there was not enough room for another reciprocating compressor. *The solution:* a Carrier Centrifugal Compressor which not only fit the limited space available but delivered more cfm of air. There were other benefits, too. The supply of air from the Carrier Centrifugal was steady, non-pulsating, and dependable. The lack of pulsation permitted Wyandotte to reduce the operating air pressure. The centrifugal could be driven by a steam



turbine and Wyandotte had plenty of steam. And of particular importance is the fact that the Carrier Centrifugal had the kind of reliability that is so essential in the chemical industry . . . it has run continuously for four years . . . 24 hours a day and seven days a week. Wyandotte has taken this compressor off stream only for yearly inspections—never for repairs. ▪ Carrier has been making centrifugal compressors for more than 30 years and has built more multi-stage centrifugals than any other manufacturer. Carrier Centrifugals have handled more different gases, too. It will pay to investigate Carrier Centrifugal Compressors when you have a new compression job or when you want to expand the capacity of existing equipment. Write Carrier Corporation, Syracuse, New York.

Carrier

centrifugal compressors

refrigerating equipment

"OUR DUST PROBLEM WAS SOLVED BY DAY'S REVERSE JET FILTER"

". . . most of our dust is very fine and varies in size from 1 micron to 25 microns. The DAY "AC" (Reverse Jet) Dust Filter solved our problem . . ."

LAPP INSULATOR COMPANY
LE ROY, NEW YORK

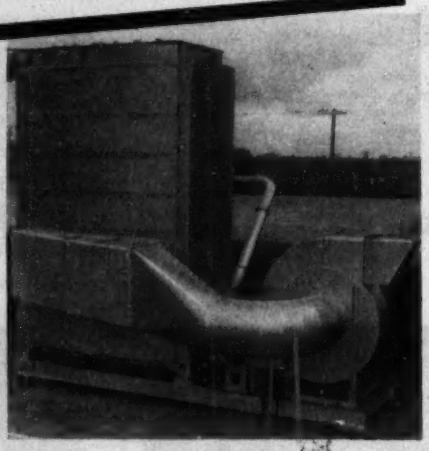


Photo of DAY "AC" Dust Filter installed by Lapp Insulator Company early in 1952.

Before installing their DAY "AC" Dust Filter the Lapp Insulator Company had tried several methods to handle the discharge of dust from their Turning Department, but as they advise . . . *"on our fine dust the other methods were only about 60 per cent efficient."*

HOW DAY'S REVERSE JET FILTER WORKS

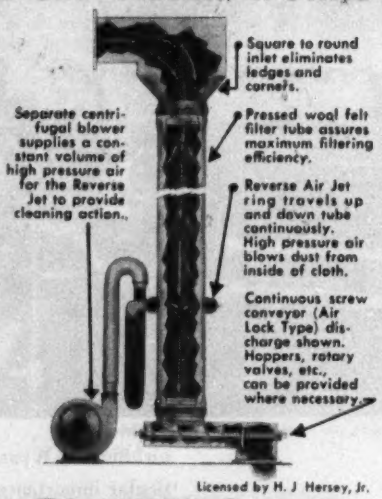
1 Continuous Reverse Jet Cleaning permits the use of *more efficient filter media* which gives filtering efficiencies up to 99.99+%.

2 Constant air volumes maintained because of continuous cleaning action.

3 Continuous, automatic operation without the necessity of shutting down any section for cleaning.

4 Air-to-cloth ratios to as high as 25 to 1, depending on dust being handled.

5 The DAY "AC" Dust Filter can be placed on either the pressure side or the vacuum side of the dust fan. Furnished with or without housing.


Square to round inlet eliminates ledges and corners.
Separate centrifugal blower supplies a constant volume of high pressure air for the Reverse Jet to provide cleaning action.
Pressed wool felt filter tube assures maximum filtering efficiency.
Reverse Air Jet ring travels up and down tube continuously. High pressure air blows dust from inside of cloth.
Continuous screw conveyor (Air Lock Type) discharge shown. Hoppers, rotary valves, etc., can be provided where necessary.

Licensed by H. J. Hersey, Jr.

The DAY Company
836 Third Ave. N. E., Minneapolis 13, Minn.
IN CANADA: P. O. Box 70N, Ft. William, Ontario
Branch Plants: Buffalo, Fort Worth, Welland, Ontario

The DAY "AC", reverse jet, Dust Filter will give you many advantages—if you want to recover product or dispose of dust. Our Bulletin Number 528 contains new information on dust control. Write for it today.

DAY SINCE 1881 DUST CONTROL
A SINGLE UNIT OR A COMPLETE SYSTEM

graphs and structural formulas. There are a few typographical errors, but only one or two statements which might confuse the reader.

To sum up, this reference work gives an authoritative and complete survey of the principles of wood chemistry. The high price, due to its publication in two volumes, is unfortunate. The subject index is excellent, but an author index would have been helpful. It is nevertheless to be recommended as a necessary addition to any library dealing in any way with wood, paper or cellulose.

Handbook

GMELIN'S HANDBOOK OF INORGANIC CHEMISTRY. Eighth edition. System No. 3. Oxygen, Part 2, 220 pages, $15.48. System No. 27. Magnesium, Part IV, 365 pages, $23.61. System No. 41. Titanium, complete, 500 pages, $27.20. Published by Verlag Chemie, Weinheim, Germany; available through Walter J. Johnson Inc., 125 E. 23rd St., New York.

Reviewed by Max Wulfinghoff

The first of these volumes deals with the distribution, properties and behavior of oxygen, its industrial production, isotopes, also the occurrence, chemistry and technology of ozone. The section on water covers its distribution and technology. Hydrogen peroxide, its properties and production methods are likewise discussed in detail.

In the second volume, magnesium alloys (binary and ternary) are covered from Mg-Zn to Mg-Re. For 31 binaries and 105 systems of higher order, phase diagrams, data on intermetallic compounds, production processes, casting methods, structural data, hardening characteristics, crystallographic, thermic, optical, electric, magnetic, and electrochemical properties are given.

The third volume presents an up-to-date review of the geology, geochemistry, metallurgy, chemistry, physics and technology of titanium, its alloys and compounds. The latter are classified in 37 groups.

As usual, all volumes are in German, with literature references given in the original language. —*End*

How to get relief
from costly acid-line replacements

This Installation Manual shows how to get full value out of the unequalled corrosion-resistant and non-contaminating properties of PYREX brand "Double-Tough" glass pipe.

The simple installation procedures it describes have been forged from the experience of many chemical and food processing companies who have found relief from excessive acid-line replacement costs in PYREX pipe.

This manual shows how to design and hang PYREX lines in a practical way. It takes you through every step of the various installation practices.

It will answer the questions you are most likely to have in mind about the everyday utility and safety of PYREX pipe. The coupon is for your convenience. We'll be glad to send you a copy free.

What this manual tells you

This Installation Manual tells what you need to know about the thermal expansion, operating pressures and temperatures, and flexibility of PYREX "Double-Tough" glass pipe.

It describes in detail the recommended methods of supporting PYREX pipe and assembling joints.

It illustrates the simple methods to take care of pressure surges in the line, vibration, and lines in areas exposed to traffic.

It details plumbing techniques any mechanic can quickly master, including connecting PYREX pipe to other materials.

Some simple procedure described in this manual may show you the way out of expensive maintenance problems. Send for a copy today.

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Plant Equipment Dept., CE-8

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Address .....

City ..... Zone ..... State .....

if this is what you need in piping

✓exceptional abrasion resistance

✓maximum resistance to corrosive oils, greases, solvents, acids and chemicals

✓low degree of swell and permeability to hydrocarbon solvents

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Supplied in either fabricated light gauge steel or standard wall. Available in 10' and 20' regular lengths or custom fabricated to your requirements . . . diameters 8" thru 48". Fittings in standard and special designs for all diameters. For catalog and additional information write Dept. C.

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Bay City • Michigan

Manufacturers of Wood-Stave, Saran Rubber-Lined, Stainless Steel and Monel Piping

Recent Books & Pamphlets

Subject	Summary	How to Order
Detergents	Compilation of ASTM standards, test methods, specifications, and definitions pertaining to soaps and other detergents, 157 pages.	"ASTM Standards on Soaps and Other Detergents (with related information)." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $2.25.
Statistical Methods	Presents statistical methods for correlating detergent laboratory test data as a useful analysis tool. Actual examples used for illustration. 44 pages.	"Symposium on Statistical Methods for the Detergent Laboratories." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $1.25.
Plastics	March 1953 edition of a compilation of standards; including specifications, test methods, nomenclature and definitions. 705 pages.	"ASTM Standards on Plastics." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $5.25.
Metal Fatigue	The statistical method of treating experimental data is presented and applied to fatigue properties of metals. This will supplement Part I, presented last year. 96 pages.	"Symposium on Fatigue with Emphasis on Statistical Approach—Part II." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $2.
Directory	A productwise listing of southern manufacturers and the sales and service organizations of firms doing business in the 14 southern states.	"Southern Industrial Directory." Southern Association of Science and Industry, 5009 Peachtree Road, Atlanta, Ga. $5.
Electroanalytical Chemistry	The latest in electroanalysis methods, equipment and theory. The annual Priestly Lectures sponsored by Phi Lambda Upsilon and the Departments of Chemistry and Chemical Engineering of Pennsylvania State College.	"Innovations in Electroanalytical Chemistry." By James J. Lingane. The Pennsylvania State College, State College, Pa. $2.
Chemical Industry	A fact-packed handbook illustrating the growth of the chemical industry and its impact on our standard of living. 108 pages.	"The Chemical Industry." Manufacturing Chemists' Association, Woodward Bldg., 15th and "H" Sts., N.W., Washington 5, D. C. $1.
Industrial Foundations	A study of the operating methods of industrial foundations, and their usefulness in attracting new industry to a community. 16 pages.	"The Organization and Operation of Industrial Foundations in Texas." By John W. Tippit. Research Report 43. Texas Engineering Experiment Station, College Station, Tex.
Synthetic Fuels	Continued progress was claimed for the eighth year under the Bureau of Mines synthetic liquid fuels program in the annual report for calendar year 1952. "The past 12 months brought a new domestic industry nearer to realization." The report is in three sections; a 17-p. summary, an 85-p. report on oil from coal, and a 70-p. report on oil from shale.	"Synthetic Liquid Fuels, 1952 Annual Report. Summary." U. S. Department of the Interior, Washington 25, D. C. "Oil from Coal." Report of Investigations 4942, and "Oil from Oil Shale," Report of Investigations 4943. Publications Section, Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa.
Australian Industry	A complete and authoritative report on industry "down under" keyed to American industry's growing awareness of Australian markets. Gives facts and figures showing the ability of Australian production to meet its markets and the opportunities and encouragement available to outside interests. 528 pages.	"The Structure and Capacity of Australian Manufacturing Industries." Division of Industrial Development, Department of National Development, 203 Collins St., Melbourne C.1., Australia.

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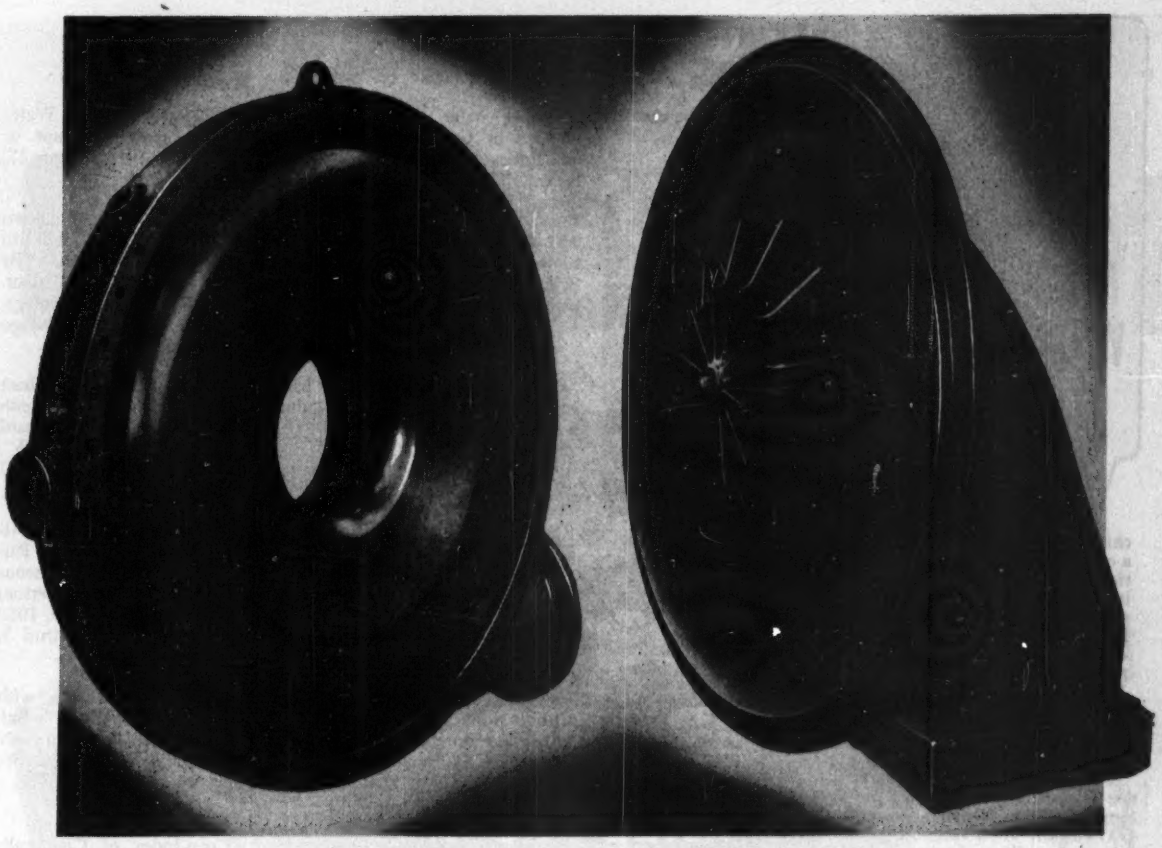
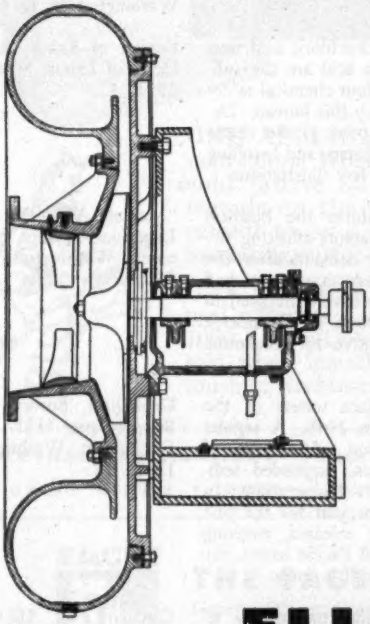


Simplicity IS THEIR STRONG POINT



Elliott centrifugal blowers have surprisingly few parts for the work they do. The single-stage blower illustrated has a one-piece cast impeller, with no sharp corners or crevices to hold foreign matter which might cause unbalance or reduce efficiency. The major stationary parts are the casing, inlet connection, backplate and base assembly, and bearing housing. All are heavy construction with sufficient rigidity to keep vibration to an absolute minimum. Objectionable noise is kept at a low level by inlet guide vanes which pre-rotate the air or gas before it enters the impeller.

In addition to single-stage blowers of the type illustrated, Elliott also builds a complete line of multi-stage blowers. Drive can be electric motor or steam turbine, both Elliott-built. Where corrosive elements are encountered, essential parts can be made of suitable alloy materials.

For full details, consult your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

CENTRIFUGAL BLOWER DIVISION

P3-2

"NO SHUT-DOWNS WITH LUBRIPLATE"

—say HENRY & WRIGHT of Hartford, Conn.

"While waiting for delivery of one of our 25-ton Dieing Machines to do a particularly heavy job, a customer was trying to start production of a 10-ton machine. Even though it was lubricated with a conventional grease every eight minutes, the machine had to be shut down for bearings to cool during each coil run. Then, on our recommendation, he changed to a LUBRIPLATE Lubricant. With but two applications of LUBRIPLATE a day, the machine operated continuously except during change of coils."

For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

RECENT BOOKS & PAMPHLETS, cont. . .

Subject	Summary	How to Order
Hydropower	Potential water power sites are mapped by Geological Survey and an "Index to River Surveys" has been published.	Geological Survey, Water Supply Paper 995. Supt. of Documents, Washington 25, D. C. 75 cents.
Oil Gas	An evaluation of the use of wetting agents in controlling the water contents of high-Btu oil gas tars as determined in laboratory studies and commercial operation. 16 pages.	"Prevention and Resolution of Tar Emulsions in High-Btu Oil Gas Production." By H. R. Linden and R. Parker. Institute of Gas Technology, Technology Center, Chicago 16, Ill. $2.50.
Ethyl Acetate	Safety rules and regulations for handling, storing and shipping of ethyl acetate are described in detail. 13 pages.	Chemical Safety Data Sheet SD-51. Manufacturing Chemists' Assn., 246 Woodward Bldg., 15th & H Sts., N.W., Washington 5, D. C. 25 cents.
Furnaces	Reports a study of combustion characteristics with insufficient air supplied for complete combustion of gas in furnaces of simple design and without external heat to influence the combustion process. First issued in 1940.	"Composition of Furnace Atmosphere Resulting from Partial Combustion of Gaseous Fuels." Bul. 11. American Gas Assn. Laboratories, 1032 East 62nd St., Cleveland 3, Ohio. $1.25.
Combustion	Outline of results obtained with and without application of heat external to combustion chambers and effects of catalysts to promote combustion at aerations lower than otherwise obtainable.	"Combustion of Gas with Limited Air Supply." Bul. 15. American Gas Assn. Laboratories, 1032 East 62nd St., Cleveland 3, Ohio. $1.75.
Alloys	Provides a single code number for alloys of similar composition covered by a variety of specifications. A reference for comparing material compositions of various specifications and faciltates compilation and evaluation of material requirements. 320 pages.	"Cross-Index of Chemically Equivalent Specifications and Identification Code (Ferrous and Nonferrous Alloys)." Defense Supply Management Agency, Handbook DSMA H 1. Supt. of Documents, Washington 25, D. C. $1.
Safety Charts	Sulfuric acid, hydrochloric acid, ammonia and nitric acid are the subjects of the first four chemical safety charts prepared by this bureau. Designed for wall posting, the charts summarize safe storage and handling practices with a few illustrations.	Bureau of Labor Standards, Dept. of Labor, Washington 25, D. C.
Markets	A report to inform the business community on factors affecting the level of civilian demand after the present defense program has reached its peak. Cooperatively prepared in 1952 by the Dept. of Commerce and the Committee for Economic Development.	"Markets After the Defense Expansion." Supt of Documents, Washington 25, D. C. 55 cents.
Water	Quality of surface waters of the United States in 1948. A regular yearly publication of records of chemical analyses, suspended sediment, and water temperature. In two volumes this year for the first time; the first released covering southwestern and Pacific basins, the second volume still in press.	Geological Survey, Water-Supply Paper 1133. Supt. of Documents, Washington 25, D. C. $1.
Water	The sixth of nine preliminary reports giving information on water supplies of the larger cities throughout the United States.	Circular 253. U. S. Geological Survey, Washington 25, D. C.

—End

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INSULATES PROTECTS FINISHES

in one quick application

ONE APPLICATION saves valuable man-hours! Whether equipment is hot or cold (above 32 F), your crew simply trowels on the white, clean-handling cement to get a smooth, light-reflectent insulating surface.

ONE APPLICATION assures high thermal efficiency at temperatures up to 1000 F. One-Cote Cement sets quickly—and when installed indoors requires no finishing treatment. In outdoor installation, a weather-protective coating is recommended.

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what's NEW in Engineering

The shortage of engineers in all fields, according to three leading universities, will continue until 1955 or 1956. Then, a more balanced supply and demand picture should emerge—thanks to heavy registration of engineering students in the past two years. Meanwhile, one major university reports that in June they had over 4,000 jobs on file—open to 260 graduates.

Microscopic sea plants, called diatomaceae, are getting a lot of attention at Lompoc, California. Deposited geologic ages ago on the floor of what was then an island sea, their fossils are highly valued in many industries for filtering, refining, and other processes. To utilize

the huge deposits at Lompoc, Kaiser Engineers recently designed and built one of the largest and most modern Dicalite plants in the nation for Great Lakes Carbon Corp. We'll send you a reprint of an article in *Industrial and Engineering Chemistry* which tells the story of Lompoc's diatoms.

Chi-Teh Wang, N. Y. U. aeronautical engineering professor, has written a book on a new approach to elasticity. To be published by McGraw-Hill in August, *Applied Elasticity* presents useful analytical and numerical methods of applying fundamental elasticity theories.

Did you know that Kaiser Engineers is noted for widely diversified engineering talents? Departments include civil, structural, electrical, mechanical, architectural, process and production, mining and geology, metallurgical and chemical—all prepared to work closely together on any project. When you have a problem in engineering, call or write Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, Calif

CE's Guide to *NEW TECHNICAL LITERATURE*

What's New In . . .	How to . . .	Company . . .
Copper Alloy Tubes (A)	. . . select copper base condenser and heat exchanger tube alloys for use in the chemical, petrochemical, power and processing industries. Detailed corrosion data is illustrated with numerous micrographs and charts. 156 p.	Bridgeport Brass Co., Bridgeport 2, Conn.
Gearmotors (B)	. . . apply gearmotors to low-speed jobs and adjustable speed drives. Table lists over two hundred applications, explains proper selection. 16 p.	General Electric Co. Schenectady 5, N. Y. Bul. GEA-1437H
Motors (C)	. . . use ¾ to 3-hp. electronic adjustable speed motors on processing operations. Description of components, accessories, and torque characteristics. 12 p.	Reliance Electric & Engineering Co., 1088 Ivanhoe Rd, Cleveland 10, Ohio. Bul. D-2102
Safety Equipment (D)	. . . protect workers on the job against safety hazards. Illustrations for complete line of equipment.	Parker Safety Equipment Co., 785 Lyons Ave., Irvington 11, N.J.
Steam Traps (E)	. . . handle steam condensate over wide pressure range. Lists important selection factors. 16 p.	Velan Engineering Co., 1 Exchange Place, Jersey City, N. J. Cat. 500
Sterilizers (F)	. . . sterilize, using either hot or cold process. Information included on combination unit. 16 p.	American Steriliser Co., Erie, Pa. Cat. C-113
Ejectors (G)	. . . apply steam jet aspirators for process vacuum requirements. Twelve case studies with sketches.	General Industrial Development Corp., 270 Park Ave., New York 17, N. Y.
Electrolyser (H)	. . . produce highest purity hydrogen with production size electrolyser. Operating characteristics curve and efficiency table. 8 p.	General Industrial Development Corp., 270 Park Ave., New York 17, N. Y.
Pump Seals (I)	. . . seal oil refinery process pumps with mechanical seal having minimum number of components. Six sketches. 8 p.	Sealol Corp., 45 Willard Ave., Providence 5, R. I. Bul. 9
Gage (J)	. . . select gages for process applications requiring precise measurement. Description of component parts with pictures. Models described for various services, dimension drawings and specifications.	Helicoid Gage Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn. Cat. G-52
Tubing Steels (K)	. . . evaluate alloy tubing steels for operation under stress at high temperatures for long periods of time. Tabular listing of stress rupture data.	The Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa. Bul. TDC-153
Welding Electrodes (L)	. . . use low hydrogen electrodes to obtain good weldments with hardenable steels, sulphur steels, or enameling steels. Includes history, procedure, and applications. 8 p.	Alloy Rods Co., York, Pa. Bul. AR53-18
Gas Analyzer (M)	. . . analyse gas concentrations using thermal conductivity equipment. Specifications for units to measure various gases. 8 p.	Leeds & Northrup Co. 4934 Stenton Ave., Philadelphia 44, Pa. Bul. ND46-91 (2)
Flocculator (N)	. . . flocculate solids in water, sewage and industrial wastes with paddle type flocculation units. Design details, performance, and construction features.	The American Well Works, Aurora, Ill Bul. PF-1, 3, 5, 7, 9
Clarifier (O)	. . . remove suspended solids from industrial waste water and industrial water supplies by flotation with tiny air bubbles. 8 p.	F. S. Gibbs, Inc., 2300 Washington St., Newton Lower Falls 62, Mass.
Feedwater Heater (P)	. . . deaerate and heat boiler feedwater using available sources of waste heat. Tabulation of heater design characteristics, outline of selection considerations.	Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y.
Circuit Breakers (Q)	. . . reduce down time and maintenance by replacement of fused devices with circuit breakers. Complete design and operating details are included.	Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa. Bul. B-5456
Manometer (R)	. . . measure absolute pressure, gage pressure, or differential pressure up to 600 in. of mercury or water using a pressurized manometer. Explains operating principles with help of suitable illustrations. 12 p.	The Meriam Instrument Co., Cleveland 2, Ohio. Bul. 28
Magnets (S)	. . . protect against tramp iron through application of high-power suspended magnets over moving belt conveyors. 8 p.	Magnetic Engineering & Mfg. Co., Clifton, N. J. Cat. 752
Pumps (T)	. . . overcome stuffing box difficulties by proper selection and installation of packing material.	Taber Pump Co., 288 Ehm St., Buffalo 3, N. Y. Bul. S-147
Gas Analyzer (U)	. . . continuously analyse for gases and vapors which will ionise either directly in water or when decomposed by heat. Equipment operation, performance and typical applications are detailed.	Davis Emergency Equipment Co., Inc., Instrument Division, 43 Halleck St., Newark, N. J.
Pump Plungers (V)	. . . install correctly ceramic plungers in reciprocating pumps. Lists chemical and physical properties of plungers and manufacturing process.	Worthington Corp., Reciprocating Pump Div., Harrison, N. J. Bul. W-404-B5
Electric Motors (W)	. . . gain a well-rounded picture of the selection; application, and construction of electric motors. 26 p.	The Louis Allis Co., Milwaukee 7, Wis.

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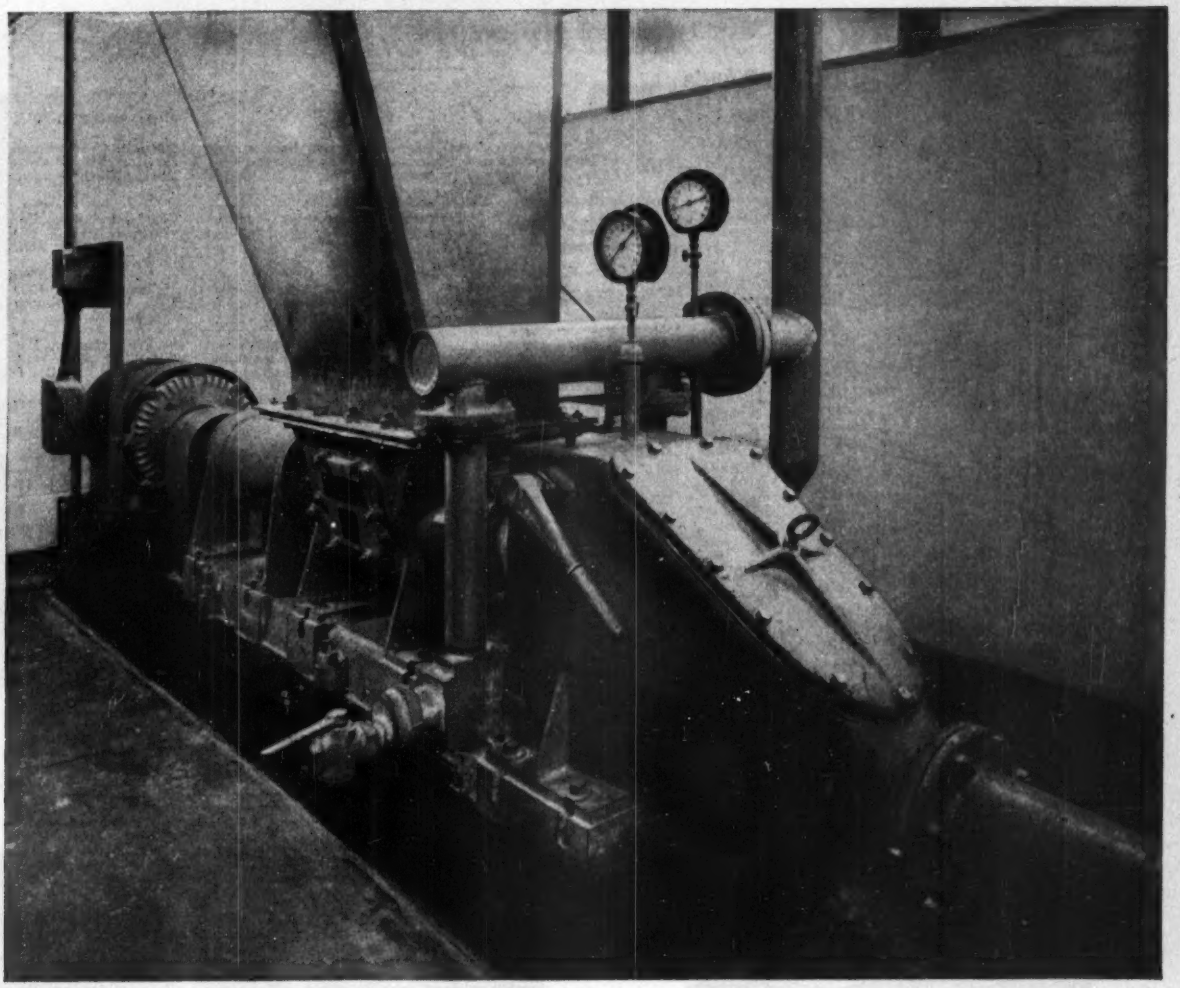

speeds handling of flash-dried starch with FULLER-KINYON

In Hammond, Indiana, the unique, new starch processing operation of American Maize-Products Co., uses the Fuller-Kinyon Conveying System to *float* the final product to bagging departments.

Careful engineering presaged the introduction of this method, new in starch processing. And the same creative engineering found the Fuller-Kinyon System the best solution to quick, economical and sanitary conveying of the dried starch product.

After flash-dried starch is processed to a 12 per cent moisture content, it is conveyed by a Fuller-Kinyon Pump to either dextrine or starch bagging departments. This includes travel through 600 ft. of piping at a rate of 12,500 lb. per hr. Push-button control is used to direct the product stream to the desired point of delivery.

Air conveying of dry, pulverized materials has had specialized engineering treatment at Fuller for twenty-six years. This experience is available to you, without charge, for the examination and installation of Fuller air conveying systems, to save you money. Write today for complete information.

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CONVEYS BY AIR
CLEAN...FAST...EFFICIENT

FULLER COMPANY, Catasauqua, Pa.
120 S. LaSalle St., Chicago 3—420 Chancery Bldg., San Francisco 4

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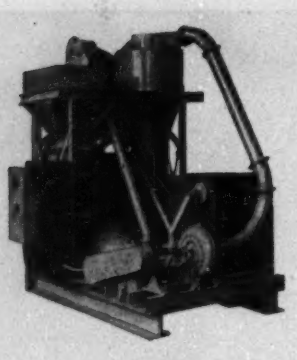
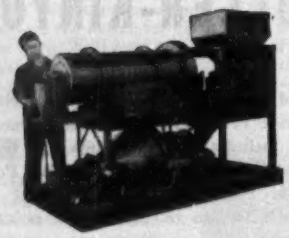
DRY MATERIAL CONVEYING SYSTEMS AND COOLERS—COMPRESSORS AND VACUUM PUMPS—FEEDERS AND ASSOCIATED EQUIPMENT



DRY GRINDING UNIT

Make power connections only and the Hardinge Dry Grinding Unit is ready to perform. Self-contained and portable, 8' high. Complete with Constant-Weight Feeder, Conical Mill, Loop Classifier, dust collector, product collector and "Electric Ear" grinding control.

Packaged Pulverizers



WET GRINDING UNIT

Make power and water connections only and the Hardinge wet grinding unit is ready to perform. Self-contained and portable. 6½' high. Includes Conical Mill, Counter-Current Classifier, launders, feeder, pump and "Electric Ear" grinding control.

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What's New In . . .	How to . . .	Company . . .
Pumps (A)	. . . select external gear and bearing bracket type screw pumps for pumping non-lubricating fluids and semi-fluids. Cutaway and dimension drawings.	Sier-Bath Gear & Pump Co., Inc., 9252 Hudson Blvd., North Bergen, N. J.
Steam Generators (B)	. . . generate high-pressure saturated steam for economical heat transfer up to 700 deg. F. Flow diagram of generating plant.	General Industrial Development Corp., 270 Park Ave., New York 17, N. Y.
Air Pollution (C)	. . . measure fine and coarse particles suspended in air and interpret the results for correct indication of air pollution.	Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.
Waste Treatment (D)	. . . evaluate waste treatment problems and select treatment method and equipment to eliminate waste disposal problems. Chart lists waste disposal problems by industries.	% Proportioneers, Inc. %, P. O. Box 1442, Providence 1, R. I. Bul.SM-9340
Couplers (E)	. . . use quick connect-disconnect couplers on lines handling air, water, gas, oil and most chemicals. Specifications and illustrations for several models.	Snaptite, Inc. 201 Titusville Road, Union City, Pa. Cat. VP83
Burners (F)	. . . convert large boilers to oil or gas firing with a complete factory-coordinated industrial fuel-burning system that includes all system components. 16 p.	York Shipley, Inc. York, Pa. Bul. ID 53-162
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Conduit (H)	. . . protect wiring against moisture, dirt, chemicals and corrosive fumes with a flexible liquid-tight electrical wiring conduit. Suggested applications and specifications are included.	American Brass Co., American Metal Hose Branch, 692 Main St., Waterbury, Conn. Bul. UA-530
Soil Testing (I)	. . . run engineering tests on soils, concrete and bituminous materials. Over 800 pieces of apparatus are described and illustrated. 72 pages.	Soil Test, Inc., 4522 West North Ave., Chicago 39, Ill. Cat. 53
Controls (J)	. . . properly maintain electrical controls. A quick reference troubleshooting chart shows symptoms, possible causes, and cures. Check list for preventive maintenance covers 26 points.	Allis-Chalmers Mfg. Co 1147 South 70th St., Milwaukee, Wis. Bul. 14X7612A
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Valves (L)	. . . select stainless steel and monel valves for use in pulp and paper mills. Dimension tables and large-size photographs of each valve model. 4 p.	W. G. Rovang, Inc., 1945 North Columbia Blvd., Portland 17, Ore. Cat. 15
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Pumps (B)	. . . select the correct type pump for various pumping applications so that long trouble-free life will result.	Taber Pump Co., 288 Elm St., Buffalo 3, N.Y. Bul. S-146
Analyzers (C)	. . . continuously and automatically record concentration of sulphur compounds in gas streams or atmosphere. Discussion of operating principles and applications.	Consolidated Engineering Corp., 300 North Sierra Madre Villa, Pasadena 15, Calif. Bul. CEC-1810B
Materials Handling (D)	. . . speed up production and cut waste motion in materials handling with a bin box system. Various applications are profusely illustrated.	Union Metal Mfg. Co., Dept. PR, Canton, Ohio Cat. 83
Conveyors (E)	. . . design a belt conveyor for any application. Complete listing of standard belt conveyor units together with accessory equipment, such as belting, trippers, terminal pulleys, takeups, backstops, belt cleaners, etc.	The Jeffrey Mfg. Co., Columbus 16, Ohio Cat. 852
Heaters (F)	. . . pick the correct type of hot water storage heater or heat exchanger for various industrial applications. Tables give information to aid in selection.	The Patterson-Kelley Co., Inc., Warren St., East Stroudsburg, Pa. Catalog 5
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Electric Motors (I)	. . . bring yourself up to date on the new NEMA motor standards. Covers new frame dimensions for a.c. motors from 1 to 30 hp.	General Electric Co., Schenectady 5, N. Y. Bul. GEA 5995
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Modified Polystyrenes (K)	. . . properly apply modified polystyrenes in a variety of places, including battery cases, containers and toys. Seven different compounds described, four for high elongation and impact, three for medium. Properties presented as determined in ASTM tests. Bulletin C-3-161, 14 p.	Koppers Co., Inc., Chemical Division Koppers Bldg., Pittsburgh 19, Pa.
Sulfur (L)	. . . keep up with the new sources of sulfur that are supplementing current industrial stockpiles. Predicts pyrites will become major source of sulfuric acid and that price of acid will exceed $25/ton in a few years. 15 p.	Midwest Research Institute, Kansas City, Mo.
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Plastics (Q)	. . . define the behavior of plastics. Progress of a basic research project at M.I.T. described. Work on 13 samples of methyl methacrylate is giving simple empirical equations for composition type of load, rate of load application and temperature effects. Additional sponsorship being sought. 18 p.	Manufacturing Chemists Assoc., 5413 Empire State Bldg., New York 1, N. Y.
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Carbon Blacks (U)	. . . compare carbon blacks .Witco Continex FEF (Fast extrusion furnace black) compared to competitive blacks as applied in various rubbers. Comparison of tensile strength, modulus, ultimate elongation, hardness and other tests in standard or metric system. 16 p.	Witco Chemical Co. 260 Madison Ave., New York, 16 N. Y.
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(Continued)

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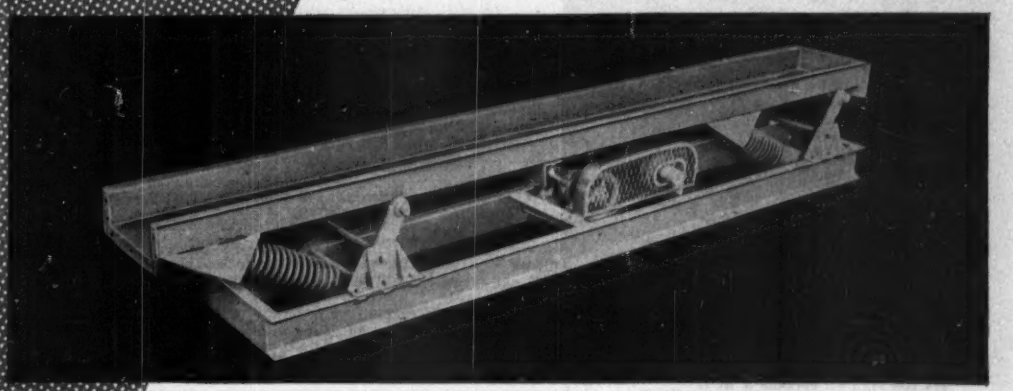
Here's the *right* way to move that hard-to-handle material in bulk—*whatever* it is—without danger of leaking, spilling, or overflow... much more economically, too.

The G-W Oscilveyor is a vibrating trough conveyor that moves material in a steady flow by short forward movements of the trough (from 600 to 800 cycles per minute, depending on the material). It's self-cleaning, comes in a variety of lengths to suit the installation, and can handle a wide range of materials with minimum segregation and breakage.

Available in either ordinary steel, stainless-clad, or all-stainless steel, the Oscilveyor is one of the latest developments of Gifford-Wood's more than 139 years experience in *engineered* materials handling. And because it's engineered, you can be sure that every part, every function, is designed with an eye to efficiency... for the utmost in operating economy.

Want more information? We'll gladly send a data sheet and show you how G-W Oscilveyors can do a real job for you. Write today.



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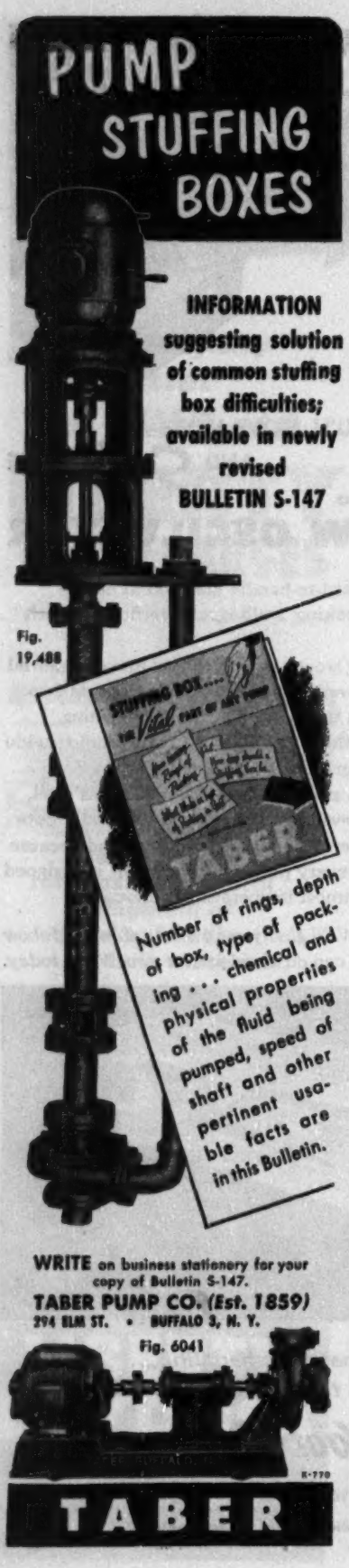
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Choline (C)	. . . best apply 2-hydroxyethylenetrimethylammonium bicarbonate, an industrial grade choline that's used as a catalyst and as an intermediate for other choline salts. 3 p.	Commercial Solvents, Corp., 260 Madison Ave., New York 16, N. Y.
Plasticizer (D)	. . . use Plastolein 9057 Dios (di-iso-octyl azelate) in low-temperature applications. Suggested applications in vinyl calendar sheeting, cast films, and in extruded products, 2 p.	Emery Industries, Inc. Dept. 5, Carew Tower Cincinnati 2, Ohio
Chlorinated Naphthalenes (E)	. . . use this company's Halowax chloronaphthalene oils and wax-like solids. Includes tables of chlorine content, electric and physical properties. 24 p.	Bakelite Co., 260 Madison Ave., New York 16, N. Y.
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Lubricants (H)	. . . lubricate plug valves to satisfy a wide range of service requirements. Lubricant selection chart and valve servicing instructions.	Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa. Bul. V-220
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Heating System (N)	. . . heat and cool plastics calenders and presses by means of high temperature water. Advantages of this system over steam. A paper by this firm's chief engineer, Paul Geiringer. 8 p.	American Hydrotherm Corp., 33-70 12th St., Long Island City, 6, N. Y.
Power (O)	. . . obtain dc power for electrolytic processes via various methods. Evaluation of the processing factors that would determine a particular choice of method. 16 p.	Westinghouse Electric Corp., Box 2099, Pittsburgh, 30 Pa.
Instruments (P)	. . . measure minute concentrations of contaminants in solution with this company's turbidity instruments, indicators and recorders. 2 p.	Ess Instrument Co., 96 South Washington Ave., Bergenfield, N. J.
Water Softener (Q)	. . . adapt zeolite water softeners to the needs of various types of plants. Principles and details of zeolite softening. 12 p.	Graver Water Conditioning Co., Dept. 108-S, 216 West 14th St., New York 11 N. Y
Chemical (R)	. . . fill pores completely, thus preventing leaks through casting walls, with a 100 percent solid copolymer. Tables provide properties of a new impregnant and the corrosives it will resist. 8 p.	American Metaseal Mfg. Corp., 30 East 60th St., New York 22, N. Y.
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Instruments (T)	. . . identify quickly elements and wavelengths (in Angstroms) from angular readings in degrees with a new x-ray calculator for use with x-ray spectrograph. (fluorescence analysis). Dial-type calculator is available for $1.	North American Philips Co., 750 South Fulton Ave., Mount Vernon, N. Y.
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—End

When you have trouble handling

Chlorine
Bromine
Fluorine

... or their compounds

When you have a corrosion or purity problem connected with the handling of halogens or halides, consider the use of the Inco Nickel Alloys. They are among the few metallic materials which are successfully used to resist corrosion by chlorine, bromine, fluorine and their halides.

Chlorine—Tests as well as practical experience have shown nickel and the high-nickel alloys to be among the most useful of the common engineering materials for handling dry chlorine at temperatures up to 1000°F.

Bromine—The high resistance of Monel shipping drums to dry bromine has enabled bromine manufacturers to ship this dangerous corrosive in original purity, without fear of contamination or breakage, while cutting shipping costs in some cases by as much as 50%.*

Fluorine—Because nickel and Monel are highly resistant to ignition by fluorine, they are preferred materials for storage cylinders, piping and valves when handling fluorine under pressure.

Sodium Chloride—Potassium Chloride—Manufacturers rely on Inco Nickel Alloys to help preserve product purity during the entire refining operation. High-nickel alloys are counted on to assure long service life for such equipment as brine storage tanks, pumps, valves, filters, evaporators and driers.

Hydrogen Fluoride and Hydrofluoric Acid — Monel is more widely applicable to the handling of anhydrous HF and hydrofluoric acid solutions over a wide range of temperatures and concentrations than any other alloy.

Magnesium Chloride—Because Inconel is free from stress corrosion cracking in boiling magnesium chloride solutions, it has been accepted as a standard material for evaporating magnesium chloride.

Calcium Chloride — For long service life, nickel and Monel linings and flights are used in the large gas-fired rotary driers where wet calcium chloride contacts furnace gases.

Aluminum Chloride — Where aluminum chloride is employed as a catalyst, Monel reaction vessels and piping are often used to resist corrosion from dilute hydrochloric acid formed as a result of hydrolysis.

If your operations with halogens or their compounds seem to indicate the desirability of employing one of the Inco Nickel Alloys, it will be advisable to place equipment orders with your supplier well in advance of scheduled use. Distributors of Inco Nickel Alloys can supply the latest information on availability from warehouse and mill.

*Other materials which are shipped in nickel drums include: acetyl chloride, benzyl chloride, benzoyl chloride, pyrosulfuryl chloride, thionyl chloride, phosphorus trichloride, phosphorus oxychloride, and thiophosphoryl chloride.

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67 Wall Street, New York 5, New York

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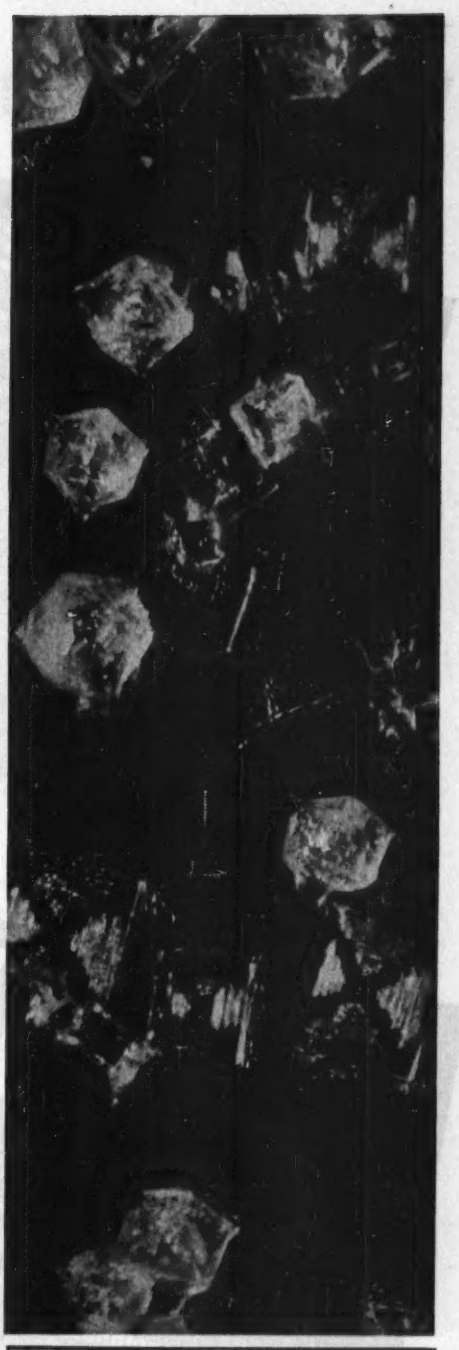


Inorganic Acid Chlorides in Which Satisfactory Uses of Monel and Nickel Have Been Recorded

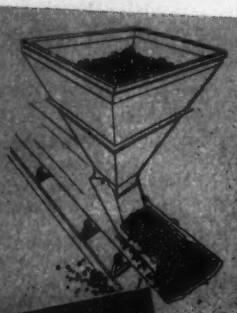
Corrosive Media	Monel	Nickel
Aluminum Chloride	Yes	
Ammonium Chloride	Yes	Yes
Antimony Chloride	Yes	
Arsenic Trichloride	Yes	Yes
Magnesium Chloride	Yes	Yes
Manganous Chloride	Yes	
Nitrosyl Chloride	Yes	Yes
Phosphorus Oxychloride		Yes
Phosphorus Trichloride		Yes
Silicon Tetrachloride		Yes
Sulfur Monochloride	Yes	Yes
Sulfuryl Chloride	Yes	Yes
Tin Tetrachloride	Yes	Yes
Titanium Tetrachloride	Yes	
Zinc Chloride	Yes	Yes

this costs money

Underloaded conveyors cost you money because they are not utilized to capacity . . . you're not getting full return on your investment . . . subsequent operations are starved for materials.

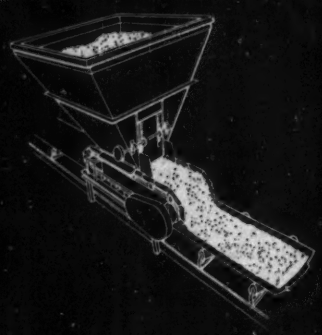
this wastes money

Overloaded conveyors cause unnecessary cleanup . . . thus waste labor. Subsequent operations are periodically flooded with more material than they can handle.



this saves money!

A properly loaded conveyor, with flow to it regulated by a Rex® Feeder, is economical and efficient . . . promotes smoothness and economy throughout entire processing operation.



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Chain

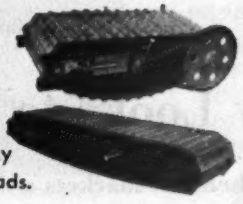
YOU save time, material, money with REX apron feeders!

Uniform, Regulated Flow...that's important when you're concerned with moving bulk materials from bin or hopper to belt conveyor or crusher. With Rex Feeders you're assured a metered, uniform rate of transfer, regardless of variation in size of material handled. Your belt conveyor or crusher will receive a steady flow of material to assure smooth, efficient, low-cost operation.

Here are some questions we are frequently asked concerning Rex® Feeders. The answers tell you why there's no question about it—Rex Feeders are your economical, money-saving choice.

Q. ***In what respects are Rex Apron and Pan Feeders superior to other feeders such as the vibrating type?***

A. Rex Self-Contained Apron and Pan Feeders require only a minimum of mechanical servicing rather than complicated electrical maintenance. Steep inclines are practical. Their efficiency is unaffected by varying loads.



Q. ***What temperature range can be handled successfully with Rex Apron and Pan Feeders?***

A. Existing installations c... handling sintered, calcined, briquetted, nodulized and similar hot material fed to them as hot as 1900° F. Chain and carrying rollers are removed from intense heat zone. Localization of intense heat can be controlled.

Q. ***What is the outstanding Rex advantage over other apron and pan feeders?***

A. The Rex Outboard Roller Construction is an outstanding advantage of Rex Feeders. Outboard rollers can be replaced without taking chain apart. Only ⅙ as many operations are required as when rollers are between side bars. Exclusive Rex Square Through Rods, seated in square holes in side plates, positively cannot rotate.

Q. ***What types of material can be handled on Rex Apron and Pan Feeders?***

A. Any relatively dry loose bulk material...hot or cold. Some of those most commonly handled are:

- Coal
- Ore (Metallic, Non-metallic, Mineral)
- Clinker
- Sinter
- Limestone
- Sand
- Cement Rock
- Heavy Chemicals

Ask your Rex Field Sales Engineer to give you complete information on how you can save money with Rex Feeders. Call the office nearest you, or write to Chain Belt Company, 4648 W. Greenfield Ave., Milwaukee 1, Wis.

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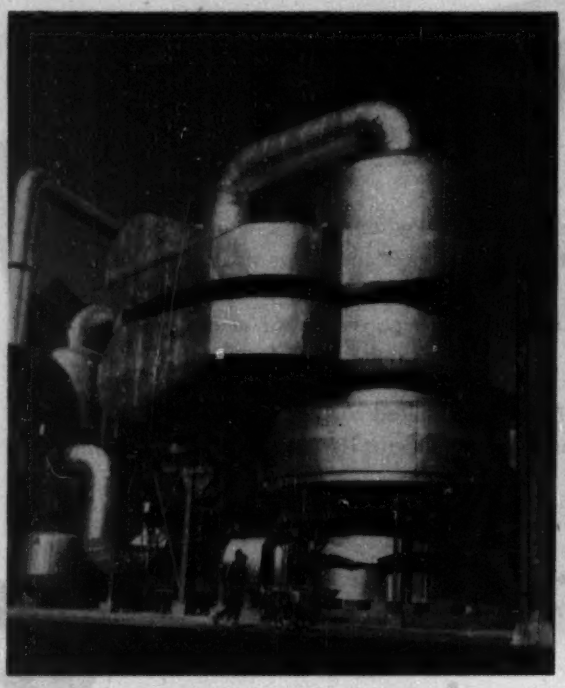

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A Resurgent Germany Looks to Chemicals

Major upheavals in the world's chemical markets are resulting from the phenomenal comeback now being staged by German chemical producers. America, look out!

German chemical output is roaring ahead. The rapid recovery is all the more spectacular when you realize that the industry was virtually wiped out by bombs, and that the little that was left was dismembered by occupation officials.

America's chemical producers are still leading the pack, but German chemical engineers are working overtime. They've come up with new products galore and they're discovering more efficient production methods. Here's the latest detailed analysis of this reborn industry, just out in a report by Otto Richter of Bad Gandersheim, Germany.

▶**The Fall From Grace**—Prior to World War I Germany led the world in chemical manufacture and export. And German products had an unmatched reputation for high quality, too. During the first World War, though, American output expanded rapidly. And in the 1920's this nation wrested chemical production supremacy away from the Germans.

By 1925, for example, the U.S. produced 43 percent of the total world supply of sulfuric acid, while the German share had slipped to 12.5 percent. Germany produced about 88 percent of all coal tar dyes in 1913. But in 1930—under the pressure of relentless American expansion—German output came to less than half of total world production.

German chemical research did not slow up after the military defeat of 1918, however. While the industry never regained its former role as number one manufacturer, it did emerge with top honors for the quality of its products. The prestige enjoyed by German firms enabled that nation to continue as the leading chemical exporter until the outbreak of World War II in 1939.

As a result of the war, the German industry was completely shattered. The subsequent occupation and partition made matters worse. The decartellization policy of the western allies produced the dissolution of the huge chemical combine, IG Farbenindustries AG.

And immediately after the war all chemical research was forbidden. Technical education in schools and colleges became virtually non-existent. And many chemical plants that had survived the wartime bombing raids were dismantled.

▶**Comeback in Production**—There are many reasons why German chemical production has shown such spectacular progress in recent years. The decision to drop the Morgenthau Plan—which sought to turn Germany into an agricultural state—was one of the early key factors. Currency reforms

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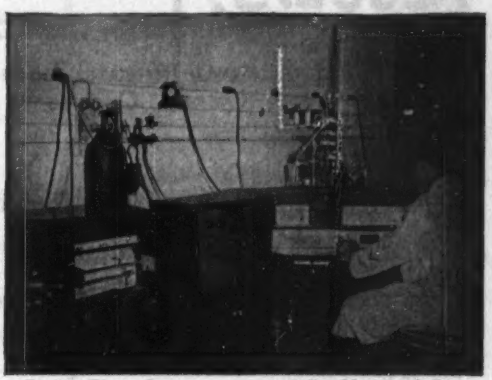

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and Marshall Plan aid helped to contain inflation and get production back on its feet.

Perhaps the most important single factor of recent years has been the program of western mobilization growing out of the tensions between the U.S. and Russia. In recent months the U.S. has relaxed almost all the bars on German industrial output and has even supported the inclusion of German troops in a European army.

In 1951 West German chemical output was valued at $2.3 billion. This was exactly the same as the 1938 value of output in the area that is now Western Germany. While this may seem like a remarkable comeback for a country so recently vanquished in war, the Germans are far from satisfied. They point out that U.S. and Russian chemical output trebled in the same period. And in Britain chemical output doubled.

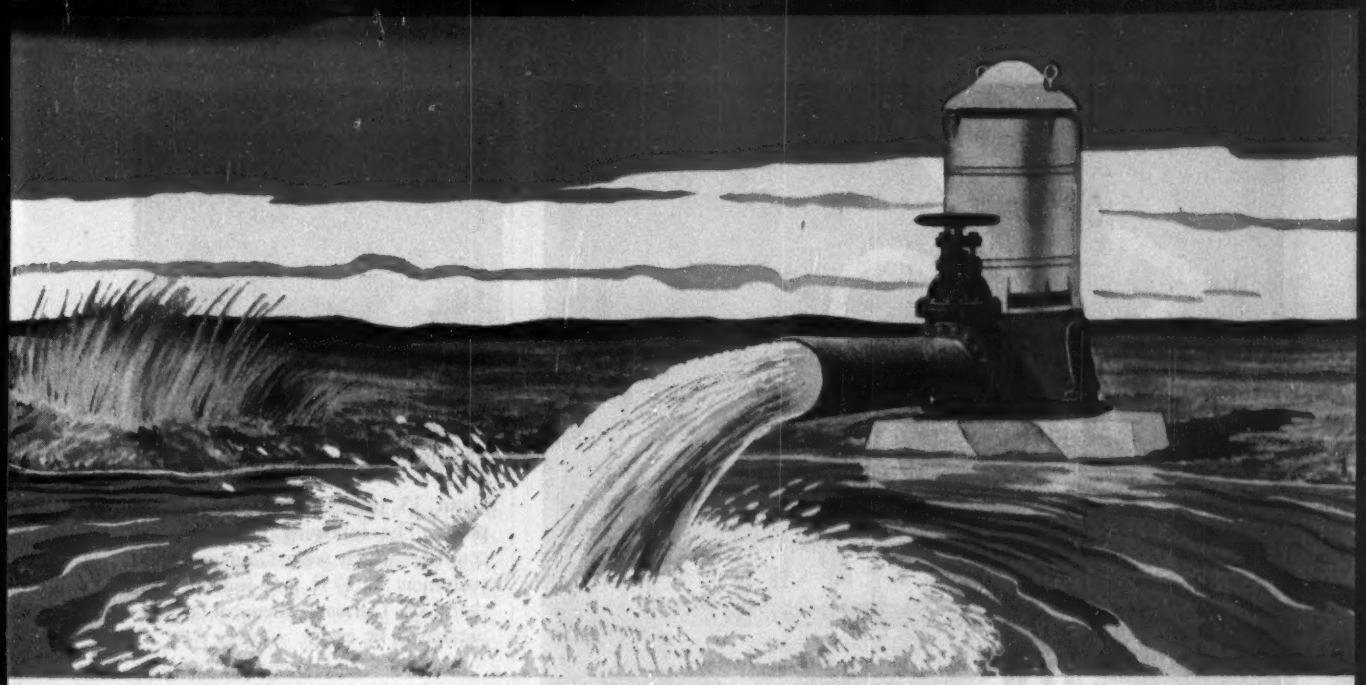
And it must be remembered that German chemical production started rebounding from a zero level in 1946. Look at these jumps:

	Thousand Tons Produced	
	1949	1951
Sulfuric acid	930	1,400
Chlorine	170	260
Sodium carbonate	570	840
Sodium sulfate	100	180
Calcium carbide	520	650
Acetic acid	78	160
Methyl alcohol, raw	52	100

▶ **Comeback in Exports**—It's in the export market that the American chemical engineer really comes to grips with his German counterpart. In 1938 German chemical exports amounted to $300 million. By 1951 this figure had risen to $503 million.

Germany's share of total chemical exports in this period fell, however, from 24.4 to 12.1 percent. The reason: American exports expanded from 14.7 percent of the world's total in 1938 to 27.9 percent in 1951. So great has the step-up been in U.S. exports that, over the period 1938-1951, even the British slice of world chemical sales fell from 15.6 to 13.1 percent. But despite the fact that the German chemical industry has lost ground in world trade since 1938, it still ranks third.

More than 62 percent of German chemical exports in 1951 went to European countries. Some 20 percent went to nations in the Western Hemisphere and Asian nations purchased



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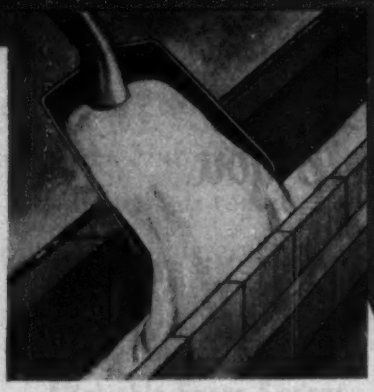

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EXPORTS of resins and plastics soaring.

about 13 percent of Germany's exports. The following table lists the countries which were Germany's best customers in 1951 and indicates the share of German chemical exports purchased by each:

	Percent of Germany's Chemical Exports Purchased
Netherlands	9.1
United States	8.5
Great Britain	8.0
Switzerland	6.3
France	6.1

Latest reports indicate that German chemical exports generally fell off in 1952. Exports of nitrogen and potash fertilizers, rayon yarns, finished pharmaceuticals, coal tar dyes, all slumped although plastics exports went up substantially.

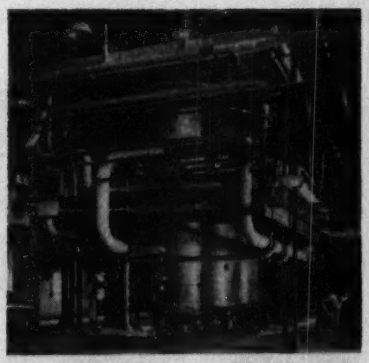
In 1951 Western Germany imported about $130 million of chemical products. The following groups accounted for more than 50 percent of German chemical imports:

	Percent of Total German Imports
Rayon	16
Heavy chemicals and inorganics	15
Sulfur ores	10
Resins	7
Drugs	7

Here are further details on the German comback in some specific chemical fields:

▶ **Fertilizers**—Germany has pioneered in the production and use of fertilizers. In 1950-1951, German consumption of nitrogen, phosphorus and potash fertilizers was, respectively, 22 lb., 55 lb. and 40 lb. per acre. U.S. consumption per acre over the same years was 6.5 lb., 13 lb. and 6.5 lb.

Germany produced 55 percent of the world's supply of potash prior to the last war. As a result of the postwar partition, only 19 of a total of 54 mines remained in Western Germany. Despite this handicap, Western Germany turned out over 1.3 million tons



DYE WORKS stress modern equipment.

last year, topping the figure reached in the last year before the war. This impressive comeback is due to the opening of several new mines plus more intensive operation of the older ones.

The recovery made in the production of nitrogen fertilizers is only a shade less spectacular. Less than half of the prewar facilities were left in the Western Zone and in 1949-1950 Germany had to import 40,000 tons of nitrogen fertilizers. But the 1951-52 output of 530,000 tons more than covered domestic requirements. The surplus–about 150,000 tons–was exported.

Germany depends on foreign materials–raw phosphates and pyrites–when it comes to phosphorus fertilizers. More than 60 percent of the supply of this key material goes to the German farmer in the form of Thomas-phosphate, a byproduct of iron and steel manufacture. As the German steel industry continues to expand, the need to import this commodity from Belgium and Luxembourg will lessen.

▶ **Coal Tar Dyes**–Before World War II Germany produced 43 percent of the world's supply of dyes; the U. S. share was only 21 percent. And Germany's military defeat meant not only reduced productive capacity, but more important, the loss of many of her key markets.

The very substantial textile industry in Eastern Germany uses dyes produced in its own zone. Asian markets, too, were lost. And Germany had to face stiff competition from U. S., British, French and Swiss dye producers when it tried to sell in western markets.

Hurdling many obstacles, German producers, in 1951, regained their role as the number one exporter of coal tar dyes. Over the period 1949-1951, Germany boosted exports by

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DRUG production hits its stride.

almost 700 percent and now supplies about 33 percent of total dye exports. Switzerland is a close second with about 30 percent, and Britain and the U.S. follow with about 12 percent each.

▶ Drugs—Before the war Germany had an outstanding reputation for the variety and quality of its pharmaceutical preparations. The seizure of all patents abroad as well as the loss of trademarks was a severe blow to the German drug industry.

Germany's long technical experience in this field explains the recent gains made by its drug producers. In 1951 drug exports amounted to about $45 million as against $30 million in 1938. But German producers are far from satisfied with the progress to date. They point out that world consumption has risen sharply. At present Germany supplies only 8 percent of total drug exports as compared to its prewar share of 40 percent.

Though German chemists retain their former skills, the industry has yet to regain its reputation for high quality. Before the war nearly 80 percent of German drug exports were in the form of finished preparations. Now this figure has fallen to 40 percent. The rest consists of pharmaceutical chemicals and semi-finished preparations.

Despite the fact that Germany was cut off from markets and technical developments in the years immediately after the war, her chemists have caught up fast with the rapidly advancing fund of scientific information in the field. They've already made important contributions in the fields of vitamin and hormone preparations, new anti-TB compounds and many others.

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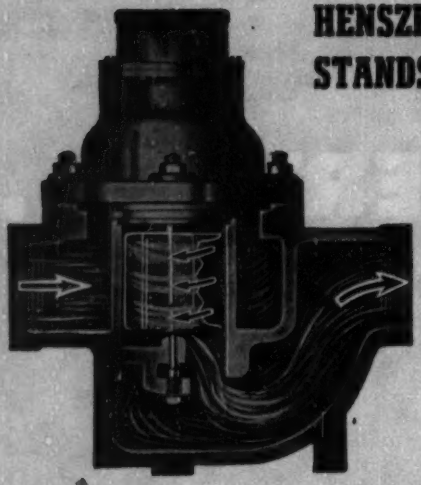

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aware of the great growth of the American drug industry, but they feel sure that Germany will be able to improve its position radically in the coming years.

▶ **Plastics**—Germany was able to stay abreast of this country in the prewar years when plastics were in their infancy. But once again, the U.S. captured decisive leadership during and immediately after the war.

German production is now on the move, however. Plastics exports rose from $7 million in 1950 to over $24 million in 1951. With markets in eastern Europe gone, Germany has been selling its plastics in the Netherlands, Britain, Belgium, Italy and Denmark.

As in the U.S., polymerization products represent the latest and most successful branch of the German plastics industry. But German production in 1951 was only a sixth of U.S. output and it's not expected that German producers will be able—in the forseeable future—to unseat this nation as the leading plastics manufacturer.

▶ **Chemicals From Coal**—Germany has long been a path-breaker in the extraction of chemical products from coal. Production of coke, crude tar, crude benzene, naphthalene, tar oil and coal tar pitch have risen—on the average—about 20 percent from 1950 to 1951.

Long years of experience have taught the Germans how to make maximum use of coal and its derivatives. Even sulfur is considered to be a coal product since increasing quantities of it are being obtained as a byproduct from the purification of coal gas.

And the Germans aren't much worried about petrochemicals pushing coal out of the picture. German crude oil production in 1953 will be only about 2 million tons, while coal should top 130 million tons.

German engineers are convinced that further research will enhance the value of coal even more. They insist that many chemicals—especially aromatics like benzene and naphthalene—can always be made more efficiently from coal.

▶ **For the Future**—With America's present sizable lead in the chemical field, it's not likely that Germany will ever again catch up. But the German chemical comeback has far from spent its steam. The industry is manned by men who are experienced

in both research and production and who are intent on increasing Germany's share of world markets.

And there's another factor which may help them. Before the war Germany traded heavily with eastern Europe. Ever since the Communist attack on Korea, however, this outlet has slowed to a mere trickle. But if a truce in Korea means an easing of tensions around the world, it's certain that East-West trade will be revived. This would surely mean a spurt in German chemical production.

So long as Germany remains within the alliance of free nations, there's no reason for American chemical management to be disturbed. Our chemical industry is far too dynamic to have its rate of growth permanently slashed because of additions to the world's productive capacity.

Just remember that 40 percent of the total sales of the American chemical industry in 1951 were of products that didn't even exist in 1936. And hundreds more new American products are coming out every year.

All Time Monthly Highs Set for Seven Inorganics

Production rates for seven important inorganic chemicals soared to new heights in March of this year. So reports the U. S. Dept. of Commerce in its most recent *Facts For Industry* bulletin.

With March production figures of industrially important inorganics generally higher than those reported in February or those for the corresponding month of 2052, these chemicals were setting records: chlorine, hydrochloric acid, oxygen, phosphoric acid, phosphorus trichloride, potassium hydroxide and sulfuric acid. Here's what they did:

	Primary Production, Thousand Short Tons		
	March 1953	Feb. 1953	March 1952
Cl_2 gas	232.8	217.3	229.5
HCl (100%), total	66.0	60.6	58.9
From salt and acid	15.7	14.6	13.7
From Cl_2 and H_2	11.8	12.1	10.5
Byproduct and other	38.5	33.9	34.7
O_2 (high purity)[1]	2,332.0	2,161.0	2,156.0
H_3PO_4 (50%), total	214.7	199.8	168.3
From phosphorus	111.8	102.7	82.7
From phosphate rock	102.9	97.1	85.6
PCl_3 (100%)	1.1	0.9	0.9
KOH (88–92%)			
Liquid[2]	7.8	7.0	6.3
Solid	1.7	1.3	n.a.
H_2SO_4 (100%), total	1,270.1	1,117.0	1,174.8
Chamber process	226.9	240.0	241.5
Contact process	1,003.2	877.0	933.3

1. Million cu. ft.
2. Includes quantities later evaporated to solid and reported as such.
n.a. Not available.

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THE FUMES FROM THAT CHEMICAL ARE SO VOLATILE WHEN WE CENTRIFUGE IT, SAM, THAT JUST STATIC OR OVERHEATING WILL EXPLODE THEM!
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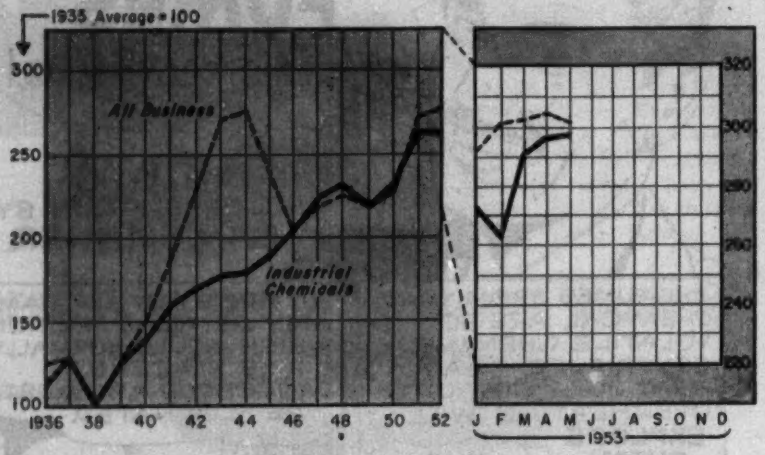
Process Industry Trends

Douglas Greenwald, McGraw-Hill Dept. of Economics

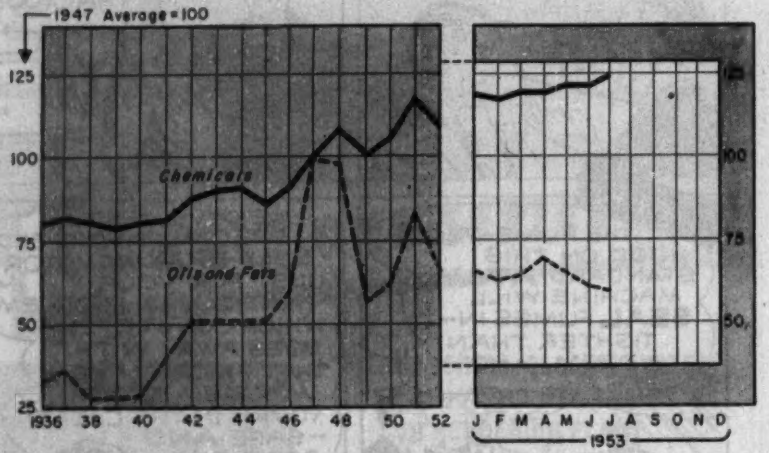
CONSUMPTION



Industrial Chemicals Index

	May (Est.)	April (Prelim.)	March (Revised)
INDEX	298.00	297.23	291.94
Fertilizer		72.12	66.80
Pulp and Paper	31.56	30.86	29.94
Petroleum Refining	28.06	26.55	28.23
Iron and Steel	18.34	17.51	18.65
Rayon	31.62	31.48	29.61
Glass		23.66	24.41
Paint and Varnish		31.53	29.12
Textiles		11.26	12.02
Coal Products		11.92	12.19
Leather	4.41	4.49	4.61
Explosives		9.00	8.49
Rubber	6.79	7.19	7.34
Plastics		19.66	20.53

PRICES

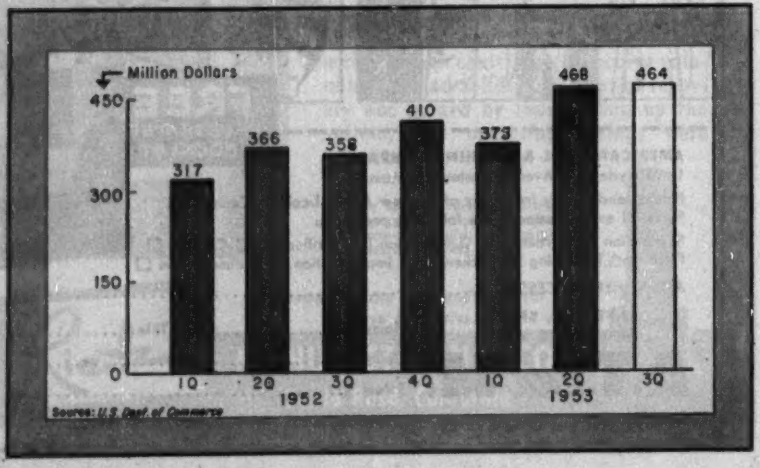


Chemical Engineering's Price Indexes

Chemicals	UP	+2.6%
Oils and Fats	DOWN	−4.0%

	Chemicals	Oils & Fats
As of July 1, 1953	125.09	58.88
Last Month June 1953	121.89	61.33
Year ago July 1952	119.62	57.85
Two years ago July 1951	118.98	80.95

HIGHLIGHT OF THE MONTH



All Time Spending High

Capital expenditures on new plants and equipment by chemical manufacturers hit an all time high in the second quarter of 1953. Preliminary estimates for the third quarter indicate a leveling off of the trend.

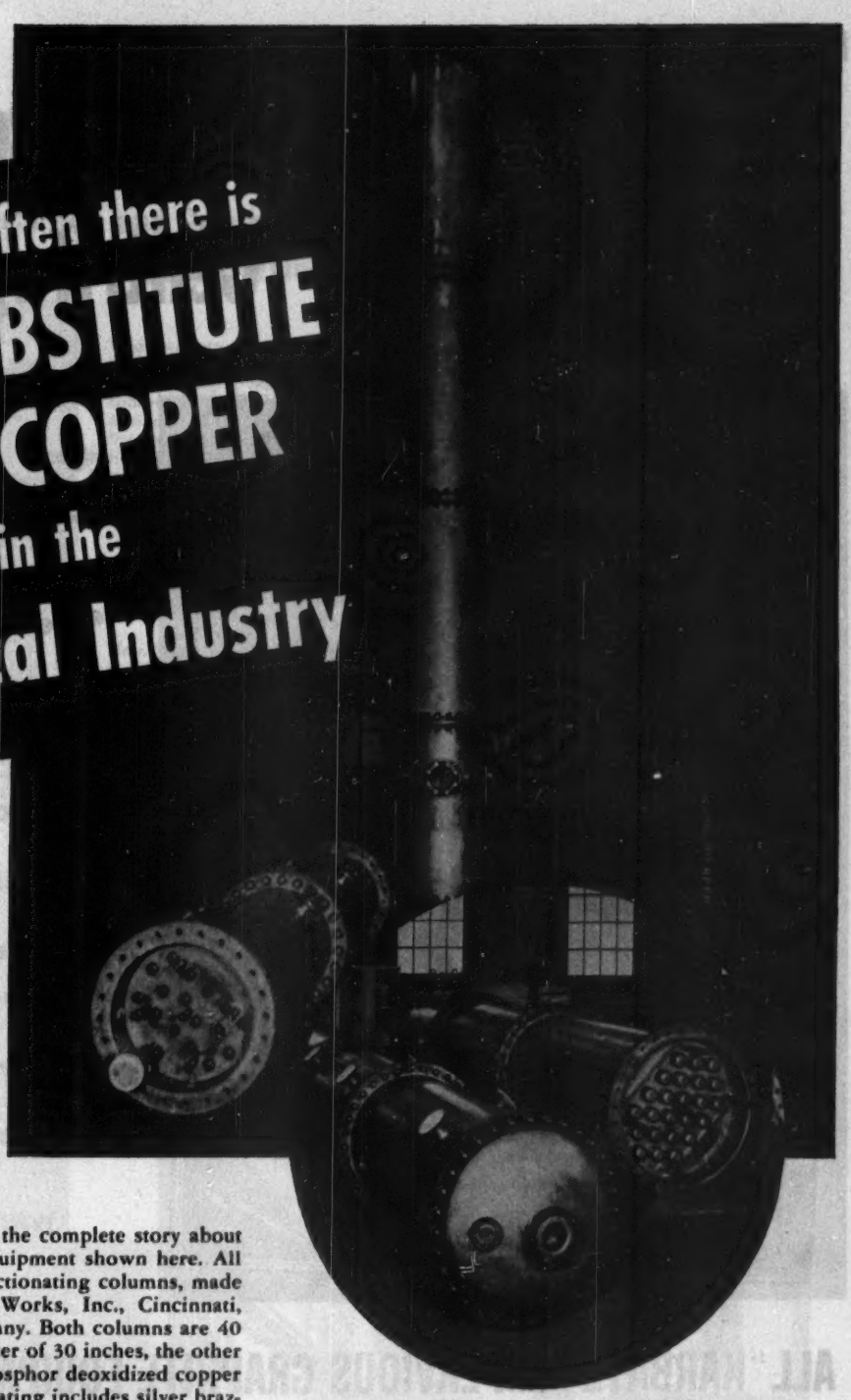
However, capital expenditures estimated for the first three quarters of this year already account for 90 percent of total 1952 expenditures. So even if the chemical industry cuts its expansion program in the last quarter, total spending will top that of last year by a considerable margin—as much as 15 or 20 percent.

So very often there is

NO SUBSTITUTE FOR COPPER

in the

Chemical Industry



Fractionating columns made by Ansonia Copper & Iron Works, Cincinnati, Ohio, for a prominent chemical company. Ansonia was established in 1896, and has always been a customer of Revere—good companies like to do business with each other!

● We wish we could tell you the complete story about the two pieces of chemical equipment shown here. All we can say is that they are fractionating columns, made by Ansonia Copper & Iron Works, Inc., Cincinnati, Ohio, for a well-known company. Both columns are 40 feet high, and one has a diameter of 30 inches, the other 24 inches. Revere supplied phosphor deoxidized copper plates, and copper pipe. Fabricating includes silver brazing with compressed natural gas.

You will find a lot of copper, various types of Revere Copper, in chemical plants. The metal has many advantages, including the highest heat transfer of any commercial metal, complete lack of reaction to many chemical fluids and gases, long life, the high electrical conductivity that is sometimes important, and surprisingly easy fabrication by stamping, bending, soldering, welding, brazing. If you are fabricating or ordering chemical equipment, look into Revere Copper. We will gladly collaborate with you on specification and fabrication matters. Just get in touch with the nearest Revere Sales Office.

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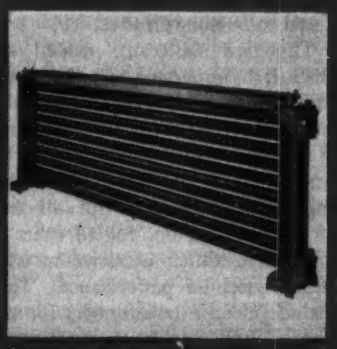
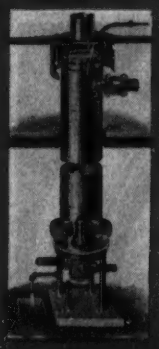
Wide variety of standard and custom-built models in time-proved designs. Shell and tube, concentric and immersion types available in stock sizes. Catalog Sections S-6620, S-6670, S-6740, S-6750.

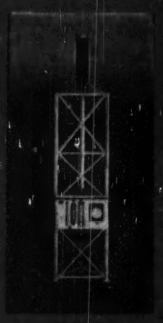


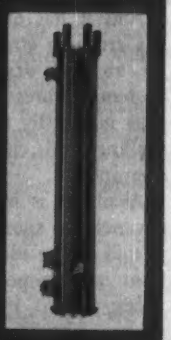
Accepted material for lining tanks, towers, digesters and other vessels containing corrosive chemicals. Catalog Section S-6210.

New "Karbate" coolers feature standardized, sectional construction . . . high heat-transfer rate . . . low initial cost. Catalog Section S-6820.

"National" Graphite Ground Anodes for cathodic protection of buried or submerged metal structures. Catalog Section S-6510.







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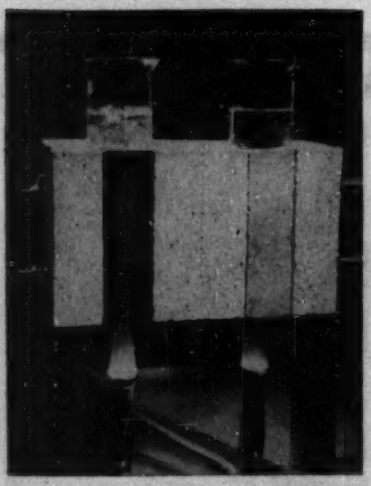
Product News

Edited by Edward T. Thompson



Silicon Carbide Brick (A)

Water boils rapidly when heated through new refractory, left, while beaker over conventional fireclay is barely warm.

Exceptional thermal conductivity makes this new silicon carbide refractory, called Carbofrax, well-suited for use in indirect heating, heat exchange and heat dissipation equipment. Said to transfer heat 11 times faster than conventional fireclay refractories, it is comparable to chrome-nickel steel at elevated temperatures.

And it has other advantages, too. It's crushing strength is over 10,000 psi. at 2,460 deg. F.; it can be used at temperatures over 3,000 deg. F.; it is inherently resistant to abrasion, spalling and cracking, and furnace atmospheres.

Available as bricks, cement and in a variety of special forms, Carbofrax is said to be ideal for such applications as recuperators, ceramic furnaces, radiant tubes and muffle furnaces.—*The Carborundum Co., Niagara Falls, N .Y.*

Desiccant (B)

Field tests show it dries natural gas better than major competitor.

A new long-life desiccant, said to have higher sorptive properties for drying natural gas, has been made available by Aluminum Co. of America.

The material, Activated Alumina H-151, is a specially prepared amorphous gel of Activated Alumina in ball form. Its high sorptive capacity and stability in service are due to its chemical composition.

Two years of field tests were made on H-151, under heavy-duty service conditions, at the Redell, La., separator battery of Continental Oil Company. In these tests, it was compared with the major competitive gel desiccant in a twin-tower dehydration unit used for drying natural gas. The results showed a marked superiority for Activated Alumina H-151.

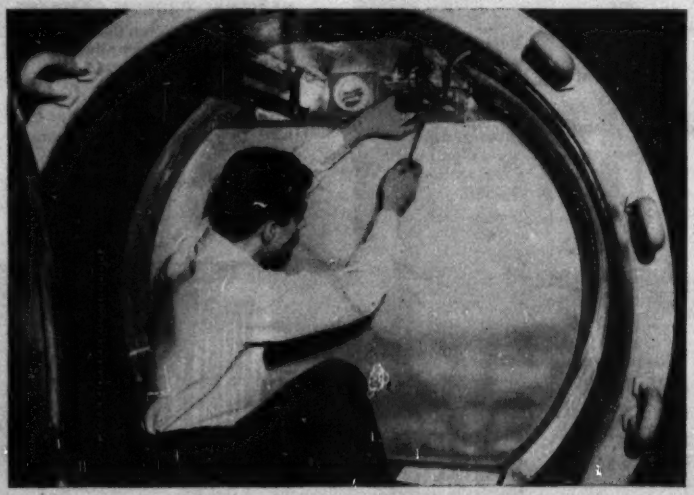
Activated Alumina H-151 and the competitive gel desiccant have practically identical initial sorptive capacities. The rate of decline in capacity for Activated Alumina H-151, however is said to be much smaller. After 20 mos. of operation, H-151 had an 80 percent greater sorptive capacity than the competitive product. At the end of 6 mos. of operation, H-151 showed little evidence of particle breakdown, whereas the other desiccant is reported to have shown excessive particle breakdown.—*Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh 19, Pa.*

Drying Agent (C)

Noncorrosive material removes moisture and acid from refrigerating systems.

Here's a new desiccant that's a chemically treated gelatinous aluminum oxide hydrate in the form of ⅛-in. diameter spheres. Powdering has been eliminated by a special process developed by the manufacturers, Ansul Chemical Co. The desiccant does not plug or channel and is efficient at temperatures ranging up to 140 deg. F. It is said to be non-corrosive.

The new desiccant, named An-Drite, is an important part of the company's new refrigeration drier unit, known as the Ansul T-Flo because of its resemblance to the letter "T". An-Drite and the T-Flo Drier have applications, not only for all users of refrigeration, but for all other industries in which excessive moisture affects machine performance. These include electric transformers for telephone lines, gasoline carburetors, natural and manufactured gas lines, and others.—*Ansul Chemical Co., Marinette, Wis.*



VINYL PLASTIC REPLACES METAL ALLOYS IN FILTER UNIT (D)

Even the nuts and bolts which hold this pressure leaf filter frame together are made from rigid vinyl plastic. Because of its high corrosion resistance and lower cost, the plastic is used for the leaf frames and the rollers which hold the frames in place. The new filter, designed by Hercules Filter Corporation, Paterson, N. J., separates a heavy manganese dioxide sludge from a hot solution of sulphuric acid. The cost of the plastic is about one-third to one-fourth the cost of special metal alloys which would resist corrosion in this application.—B. F. Goodrich Chemical Company, 324 Rose Building, Cleveland 15, Ohio.

Chlorobremomethane (A)

Reported to be 1.5 to 6 times as effective as other liquid fire extinguishing materials.

Michigan Chemical Corp. has announced quantity production of chlorobromomethane for use in fire extinguishing equipment. "CB" is said to be faster, less toxic, less corrosive, and to have a lower freezing point (−123 deg. F.).

Extinguishers using "CB" can be smaller and lighter in design. A waste fire attacked with "CB" has less tendency to flash back; there is less soot, smoke and irritating or corrosive fumes.

In liquid form it is adaptable to the usual types of vaporizing liquid extinguishers. With a low freezing point it requires no depressant. It has practically no corrosive effect on steel, brass or lead unless mixed with water. It can be pressurized with Freon, CO_2, CO_2 and nitrogen, or air. Underwriters' Laboratories will grant an approved label to any extinguisher using "CB" if it meets other requirements regarding corrosion, effectiveness, mechanical design and freedom from defects.—*Michigan Chemical Corp., St. Louis, Mich.*

Resin (B)

Glass laminates bonded with new silicone resin are said to have 100 times the dielectric life of older competitors.

Recent studies made by Dow Corning Corp. indicate that silicone-glass laminates bonded with the company's new 2105 Resin, have over 100 times the dielectric life of the best silicone-glass laminates previously available. Transformer tubes made with this new bonding resin, for instance, have maintained their original dielectric strength after aging at 250 deg. C. for more than 1,000 hr. Room temperature physical properties of these materials are similar to those of earlier silicone-glass laminates.

In addition to greatly improved dielectric life, silicone-glass laminates made with Dow Corning 2105 are considerably easier to produce. Laminates can be made at pressures from 300 to 1,000 psi. at temperatures ranging from 175 to 250 deg. C. Curing schedules range from 3 hr. press cure to a 30-hr. after-cure, depending on the properties desired.

A special catalyst, XY-15, has been developed to accelerate the setting of Dow Corning 2105. A sufficient quantity of this catalyst in the form of a solution containing 20 percent catalyst by weight is supplied with each order of resin. Additional quantities may be purchased separately.

Shelf life of the catalyst solution has been greatly extended. Although complete data are not yet available, samples of catalyzed resin have remained stable as long as 2 mos., while impregnated stock has been laminated successfully after 3 mos.' storage.—*Dow Corning Corp., Midland, Mich.*

Safety Enamel (C)

Abrasive permanently suspended in tough resins defies heavy traffic.

Silicon carbide mixed with a combination of several tough plastic resins floats in a magnetic field. The result is a new skidproof enamel, Convoy.

The silicon particles, which remain in permanent suspension, are said to give Convoy an extra tooth which regular enamel does not supply. Two years ago it was applied to runways in a Louisville feed mill. Trucks heavily loaded with feed bags are still passing safely over the original application.

Convoy is resistant to mild acids and caustics, salt spray, water, sulfur, oils and greases. It will withstand temperatures from −40 to 180 deg. F. It is a water-proof film that creates a moisture barrier when applied to metals.

It can be brushed or sprayed either interior or exterior on wood, metal, concrete or any material that can be painted. The surface should be clean, dry and free from oil and grease, and all loose or scaling paint must be thoroughly removed before applying the enamel.

Price is $7.15 per gal. in 5-gal. containers, f.o.b. point of distribution.—*Kelley-Mahorney Co., Louisville, Ky.*

Air Entraining Agent (D)

For use in low density concrete and mortar, rigid thermal insulation and light weight building products.

Foamed cement paste made with new Mearlcrete P is reported to be extremely stable and to set to a solid foam without diminishing in volume or increasing the setting time. Varying the conditions or preparation of the foam cement makes possible a product with density, thermal conductivity and compressive strength to suit any need.

Densities as low as 12 lb./cu. ft. are readily attained. At 30 lb. per cu. ft. the compressive strength of cured foamed cement is 300 psi. When used as thermal insulation, Mearlcrete P foam cement provides low thermal conductivity under widely varying conditions of temperature and humidity.

Underground pipes can be insulated with Mearlcrete P under all field conditions. No special equipment is required. A concrete conduit containing Mearlcrete P foam cement insulation is said to be rotproof,

IN BRIEF—A capsulated listing of this month's newsworthy products

It's New . . .	It's Good for . . .	See Page . . .
Silicon Carbide Brick	Refractories because of its high thermal conductivity	328
Desiccant	Drying natural gas	328
Drying Agent	Removing moisture and acids from refrigerating systems	328
Vinyl Plastic	Replacing metal alloys in filter units	328
Chlorobromomethane	Fire extinguishers	329
Resin	Bonding silicone-glass laminates	329
Safety Enamel	Resisting mild acids and caustics, salt spray and grease	329
Air Entraining Agent	Use in low-density concrete and mortar	329
Silicone Coatings	High-temperature protective coating applications	330
Germicide	Imparting germ-killing properties to paper	330
Adhesive	High strength bonds that won't dry out or weaken on aging	330
Protective Coating	Applying to damp surfaces; inert to mildew	330
Vinyl Films	Chemical and food packaging	330
Solid Formaldehyde	Processes needing dry formaldehyde	332
Calcium Carbonate	Dispersion in rubber without master-batching	334
Mold Release	Production of plastics	335
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Abrasion Furnace Black	Increasing mileage of tire treads	338
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Paper Base Laminate	Electrical equipment where fire hazards exist	339
Motor Cleaner	Replacing hazardous chlorinated solvents	339
Protective Coating	Extremely corrosive conditions	339

vermin-proof and moisture-proof, assuring positive permanent protection for the piping.

Being an easy-to-handle liquid, Mearlcrete P offers no bulky storage problems. It helps reduce costs, creating its own light weight aggregate from freely available air.—*Mearl Mfg. Corp., 153 Waverly Pl., New York 14, N. Y.*

Silicone Coatings (A)

Normal aluminum paint for high-temperature uses, right, blisters at 1,000 deg. F. New silicone-aluminum paint is unaffected.

Two new silicone resins appear to have good possibilities in the chemical processing field as protective coatings.

One of these, Dow Corning 805, retains flexibility and adhesion after long aging at elevated temperatures. Outstanding resistance is claimed for 600-1,000 deg. F. temperatures and points up uses in protective coatings for hot stacks, mufflers and pipelines. Commercial quantities are available in a variety of colors from several paint manufacturers.

Another, an air-drying, modified silicone-alkyd resin, Dow Corning 807, is being used in several exterior finishes. Clear or pigmented, the coatings are said to have good weather resistance, color retention and resistance to chalking. This material can be combined with nitrocellulose to give greater flexibility, adhesion and cold-check resistance.—*Dow Corning Corp., Midland, Mich.*

Germicide (B)

Both a product and a process for imparting germ-killing properties to paper.

A process and product, both called Permachem, have been developed to impart germ killing or inhibiting qualities to materials for their useful life. According to the developer's laboratory tests, Permachem operates against a wider variety of disease producing germs, fungi and mildew producing organisms than penicillin or the other antibiotics used for this purpose.

The process binds an active agent like silver in a highly ionized form to the material. Because of the minute quantities necessary to impart the desirable killing or inhibiting properties, the price of the finished product is not appreciably increased.

Application to paper is possibly the simplest to accomplish for it can be done during several of the wet stages of paper production. The process and product have been imparted to various types of pulp as well as to a variety of finished paper without apparent change to the physical characteristics of either. Considerable interest in Permachem has already been shown by manufacturers of toilet and facial tissues, paper napkins, paper diapers, drinking cups, food containers and surgical masks.—*Permachem Corp., 270 Park Ave., New York 17, N. Y.*

Adhesive (C)

For applications requiring a high strength bond that won't dry out or weaken on aging.

A new waterproof, high heat resistant adhesive said to have exceptional strength and durability was recently developed. It is a thermosetting, self curing cement. Heat is not required.

The final glue line is completely resistant to salt and fresh water, fungus, and many acids, solvents, and lubricating oils. It is neutral when cured and will not decay cellulose fibers as will adhesives which are acid upon final cure.

Called CD Cement 300, it is expected to have many uses to the plastic, construction, aviation, and other industries which require a very high strength bond that will not dry out or lose its strength on aging. It is intended for conformance with Military Specifications MIL A5433, A5434, A397A, and AXS 1665.

It is used for bonding phenolic and urea plastic sheets (Formica, Micarta, etc.) to themselves and to wood and other surfaces. Nylon can be bonded to nylon without heat or pressure. Also, this product is of interest for cementing Lucite and Plexiglas to wood for outdoor signs because of its excellent weathering characteristics.—*Chemical Development Corp., Danvers, Mass.*

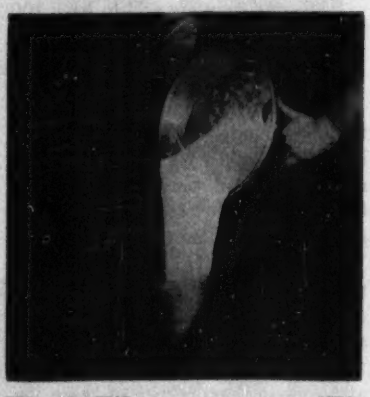
Protective Coating (D)

Bonds to damp surfaces; inert to oil, acids, alkalis, mildew.

Dampness creates a capillary attraction between Braemul, a new thermoplastic, gray-black, plasticized bituminous resin emulsion, and surfaces to be protected. It is also resistant to mildew, fungus and all minerals encountered in the earth. Therefore it is particularly valuable for applications requiring below ground and underground protection.

Not only is the coating said to be highly resistant to oils, greases and aliphatic solvents but also to acids and alkalis. It withstands temperatures from −50 to 210 deg. F. When continually submerged in liquids at temperatures in excess of 100 deg. F, it will soften but will not run, flow or sag at dry temperatures up to 210 deg. F.

Braemul is said to be nontoxic, gives off no fumes, is completely noninflammable and will not explode. —*Service Industries, 2103-05 Somerset St., Philadelphia 34, Pa.*

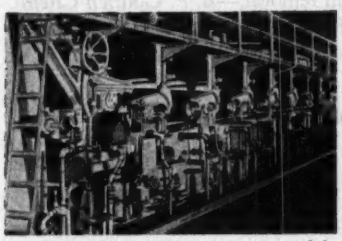


Vinyl Films (E)

Find many uses in food and chemical packagings. Use of preformed liners cuts costs.

From lard to rug cleaners; from sulfanilamide to pickle relish. This is the range of products now being packaged in two vinyl film liners called K-flex BV and K-flex DV. De-

CELITE FILTRATION removes harmful impurities and purifies water for re-use



In paper plants "White" water used in paper formation is purified for re-use by Celite Filtration. The Celite method can also provide clean pure process water in many other industrial uses—for boiler make-up, heat exchangers, circulating water for towers, etc.

In oil wells—output is boosted by re-pressurizing wells with water to force out accumulated oil. Celite Filtration purifies water to the extreme degree required—removes the minute suspended impurities which would otherwise clog the microscopic pores of sandstone.

CELITE* FILTRATION can reduce your process water costs materially—and it can greatly aid your community's water conservation and anti-pollution programs.

If your plant now discharges industrial water as waste, Celite Filtration enables you to purify this water for *re-use*—at relatively low cost. Celite removes all types of suspended solids. When required, it even filters out fine matter such as amoebae and algae, many of which cannot be removed by other methods. Thus by recycling process water you can save on water costs . . . and save your community's water.

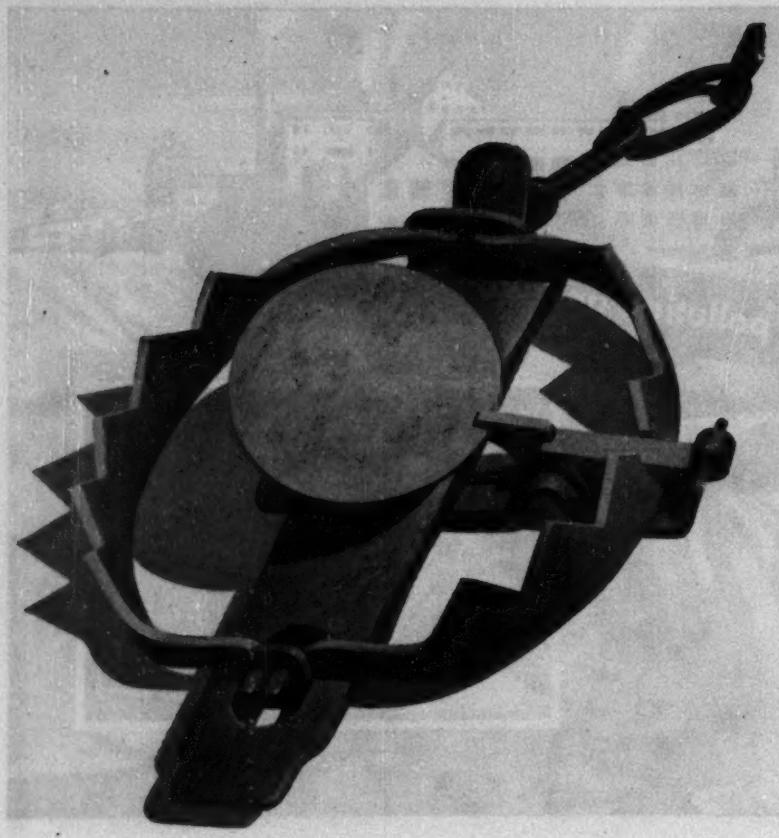
At such times as you still find it necessary to discharge process water, Celite Filtration is an important anti-pollution measure. It helps make water safe and harmless . . . thereby protecting your community's recreational areas, fish and wildlife.

Food processors, beverage manufacturers, swimming pool operators and many industrial users of process water depend on Celite Filtration.

It will pay you to investigate the unique advantages of Celite for your particular application. Celite itself is carefully processed from the purest deposits of diatomaceous earth. It comes in nine standard grades, and you are always assured of utmost uniformity of product. To have a Celite engineer study your problem and offer recommendations, simply write Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario. *T.M. Reg. U.S. Pat. Off.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville CELITE FILTER AIDS



All over your building, fire sets its traps. In dip tanks, transformer vaults, storage spaces. In fact, wherever it can stop your business in its tracks. Make sure you don't fall victim. Post a KIDDE Portable Extinguisher next to every fire hazard.

Kidde

Walter Kidde & Company, Inc.,

828 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

veloped by Goodrich to prevent fats and oils from migrating through their packagings, the two products are being marketed by R. L. Kuss and Co., Findlay, Ohio.

BV is made from Goodrich's Geon polyblend, a polyvinyl chloride plasticized with Hycar nitrile rubber. It is recommended for use where grease resistance is needed, but at temperatures above 0 deg. F. Tensile strength is about 2,200 psi. and the film has an elongation of over 200 percent.

The DV film is designed for nonfat applications and can be used at temperatures as low as —40 deg. F. Made from straight Geon vinyl resins, it has a tensile strength of 3,000 to 3,500 psi. and an elongation also over 200 percent.

Both films are claimed to be nontoxic, impermeable, abrasion resistant, flexible at both high and low temperatures, noncombustible and resistant to acids, alkalis and most other solvents.

Kuss claims that lard packaging costs, for example, can be cut more than 50 percent by using pre-formed, K-flex film liners instead of conventional metal containers. Absence of voids, wrinkles and folds in the liners means that materials which solidify after being poured are not wasted upon removal.—*B. F. Godrich Chemical Co., 324 Rose Building, Cleveland 15, Ohio.*

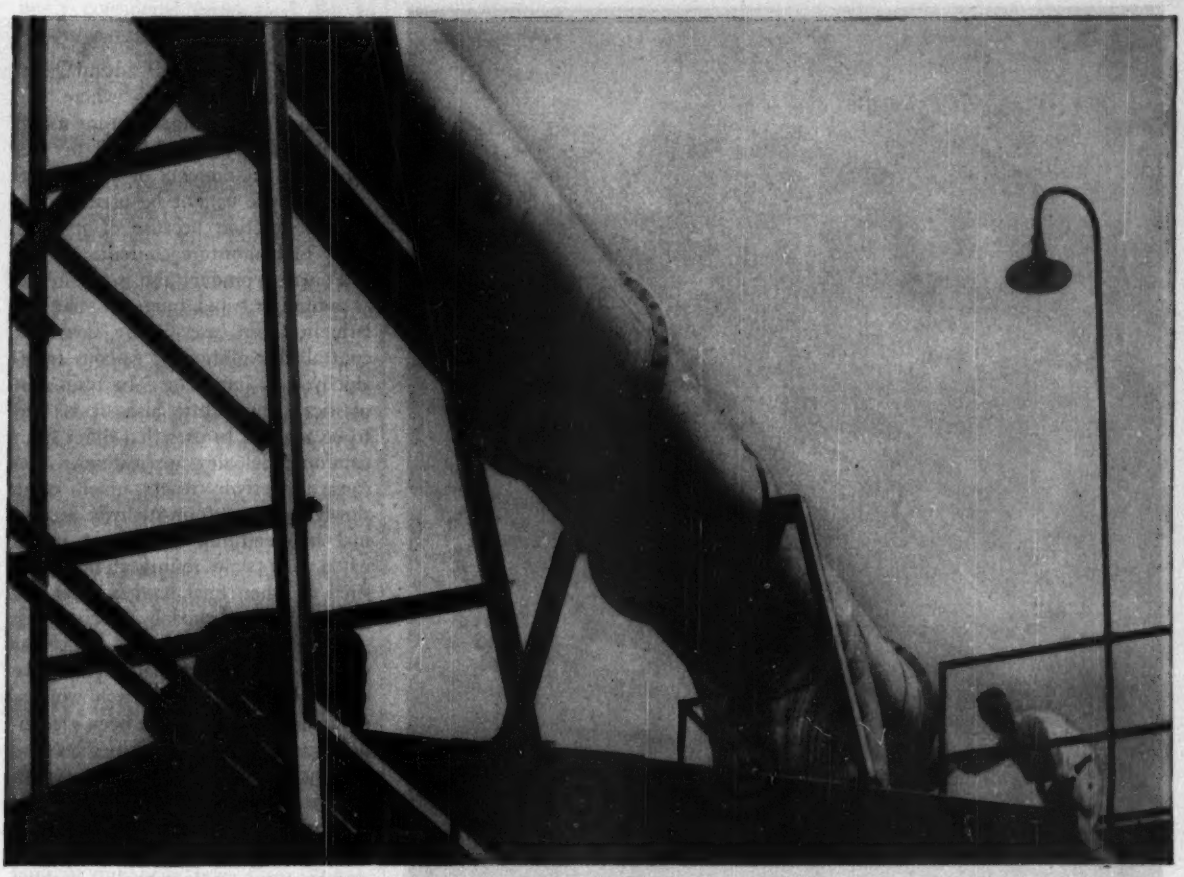
Solid Formaldehyde (A)

For processes calling for formaldehyde where presence of water is a disadvantage.

Heyden Chemical Corportaion has developed a new solid form of formaldehyde, with less than one-tenth of one percent water content. It is now producing the new product in commercial quantities by an unusual special process.

Called Superfyde, it is somewhat similar to paraformaldehyde in chemical structure, but has a higher molecular weight and melting point. It is suggested for a variety of uses in applications where paraformaldehyde and other types of formaldehyde are not well adapted.

Superfyde is of special interest as a source of dry formaldehyde in the manufacture of chemical intermediates and resins. Its very low water



A "COLUMBIA" Trade-Mark *Activated Carbon Solvent Recovery Plant . . .*

. . . at the end of this duct is saving this man thousands of dollars a year. His installation is one of the many that save industry more than $150,000,000 annually by recovering over *2 billion* pounds of solvent vapors!

COLUMBIA Activated Carbon solvent recovery plants are used in a variety of industries—plastics, rubber, synthetic fibers, smokeless powder, rotogravure printing, lacquer coating, and many others where solvents are vaporized.

Alcohols, esters, ethers, ketones, hydrocarbons, chlorinated compounds, and practically all mixtures of these or other low-boiling solvents are recovered efficiently and economically.

EFFICIENCY OF RECOVERY: 99%+ of the solvent vapor that reaches most plants is recovered.

COST OF RECOVERY: Less than 0.5¢ per pound of solvent, in many cases.

If you vaporize solvents in your process, let us help you. We can design and supply a complete solvent recovery system to fit your specific requirements.

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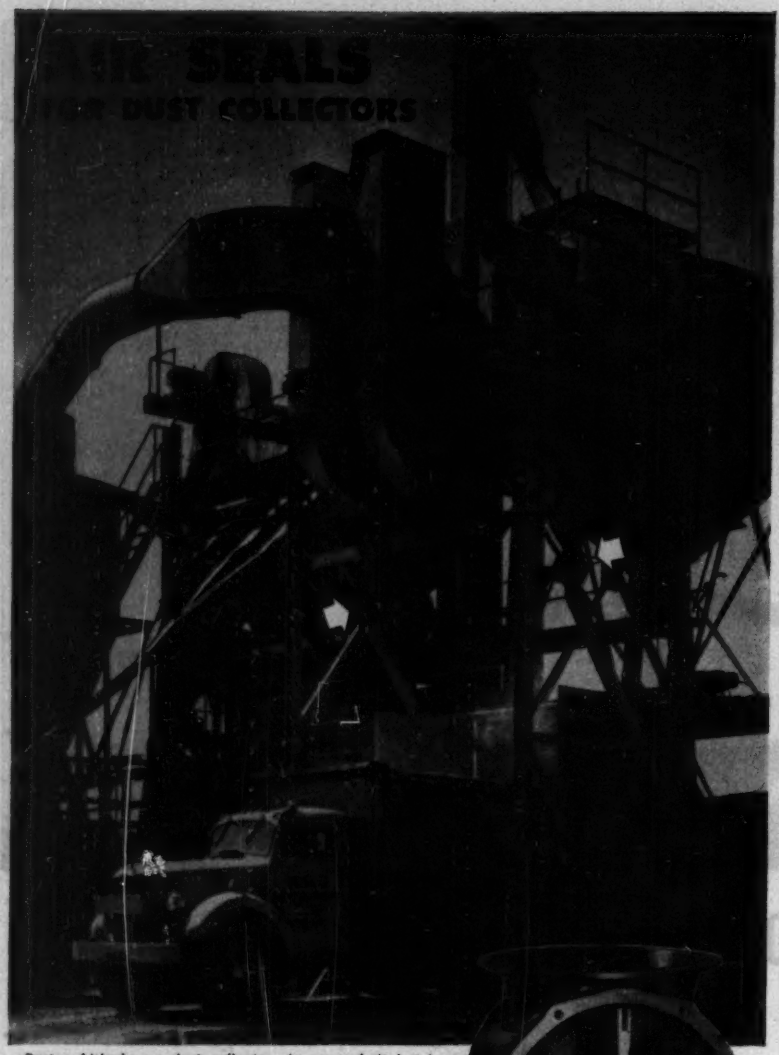
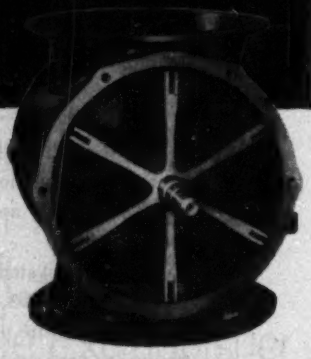


Prater Airlocks on dust collectors in an asphalt batch plant. (Photo courtesy Dustex Corp., Buffalo, N. Y.)



PRATER ROTARY AIRLOCK FEEDERS

Where finely ground or granular products are to be removed from dust collectors, air classifiers, bag filter compartments, spray or rotary dryers...you can do it efficiently and economically with Prater Rotary Airlocks. Sealing off the bottom discharge of dust collectors, they prevent air leakage and feed the dust collected from the system. Used as a feeder, they propel materials into pneumatic conveying lines or other processing equipment against pressure.

The Prater Feeder can be equipped with a variable speed transmission to feed materials continuously at a pre-determined rate. Volume can be changed instantly. Prater Rotary Airlock Feeders are made in three sizes — 8", 10", 12" with renewable rubber wiper strips set in machined slots to form an all-around tight, but flexible, seal protecting the rotor against air leakage (see open end view above).

WHAT'S YOUR PROBLEM? Jot down the details of your application and mail them to us. Our engineers will help you plan your flow sheet and specify the proper equipment.

PRATER PULVERIZER COMPANY
1517 S. 55th Court, Chicago 50, Ill.

content is of particular advantage in many organic reactions where the properties of formaldehyde are useful but its reaction is inhibited or prevented by the presence of water. Paraformaldehyde cannot be used in this type of reaction because of its relatively high moisture content.

This new product also is of interest as a fumigant and fungicide, particularly in those cases where slow and controlled evolution of gaseous formaldehyde is important. In resin and plastics manufacture also, it is said to be adapted to uses that differ from paraformaldehyde applications. Because Superfyde reacts much more slowly than paraformaldehyde at normal temperatures, it is most useful when very slow resinification is desired or when final hardening of the resin is accomplished by heating.

Although very high molecular weight, solid-type formaldehydes have been known among research workers for some time, they have been pigeonholed as laboratory curiosities because no practical means for volume manufacture had been developed.

Heyden says that its new commercially process was developed by a research team systematically seeking new uses for formaldehyde.—*Heyden Chemical Corp., 393 Seventh Ave., New York 1, N. Y.*

Calcium Carbonate (A)

Coated ultrafine calcium carbonate solves some dispersion problems for the rubber industry.

A new coated ultrafine calcium carbonate for the rubber industry, Purecal SC, is now commercially available. Made for easy dispersion without special handling, it is said to eliminate master-batching. Even in GR-S rubbers where ultrafine carbonates are generally satisfactory, material quality benefits are claimed when Purecal SC is substituted.

Purecal SC's unique coating is believed to be the first offered commercially which does not retard the cure. Purecal SC gives essentially the same excellent properties as those heretofore attributed to the uncoated ultrafine carbonates.

The manufacturer predicts that Purecal SC means better rubber products at less cost and that, using ordinary factory methods, it will open the field to many rubber compounds for-

merly considered impractical due to handling difficulties. — *Wyandotte Chemicals Corp., Dept. SC, Wyandotte, Mich.*

Mold Release (A)

For the plastics industry, it should mean less rejects and maintenance cost, more mold life.

Fast drying CD Mold Release B is intended for production work. One application will usually last for many cycles. It can be applied by spraying, brushing, or wiping with a cloth which has been saturated in the solution.

CD Mold Release B does not react with the above resins or inhibit their cure. On heated dies, there has been no sign of carbonization or build-up. It is colorless and clean. It has a low surface tension and therefore quickly spreads over the entire mold surface.—*Chemical Development Corp., Danvers, Mass.*

Butyrolactone (B)

Intermediate for aliphatic and cyclic compounds, general solvent.

Butyrolactone is now available in tank-car quantities from General Aniline & Film Corp. This material, structurally the inner ester of gammahydroxybutyric acid, is a chemical intermediate of great interest for aliphatic and cyclic compounds and has been used in a methionine synthesis and for making N-alkylpyrrolidones.

It is a liquid from —44 to 204 deg C. and is therefore of value as a general solvent. It is of special use as a solvent for acrylonitrile polymers and other high polymers and is also a selective solvent for acetylene in natural gas and other gases.—*Commercial Development Dept., General Aniline & Film Corp., 435 Hudson St., New York 14, N. Y.*

Scale Remover (C)

Modified form of compound developed to remove and prevent scale in oil wells does the same job for boilers.

In actual plant use, a new product called B compound has proved successful at combatting scale problems which arise where steam is generated.

For about five years a similar material has been used in wells to keep

WHEN PUMPS WEAR OUT ...WHO IS AT FAULT?

One of many Waukesha Pump "Life-Savers," this simple petcock can add *months* to pump service! Use it to drain condensate from your pump every time you clean it — daily. It's *important!* If you leave condensate in your pump, you saponify the oil . . . Your oil loses its lubricating value, and you have rapid wear on the ball bearings, causing misalignment of shaft — resulting in excessive wear on impellers and pump body. Shorter pump life, early repair and need for replacement!

SAVE YOUR PUMP . . . Make the "Petcock-Check" *every* day. Let it drain until the oil runs clear. Then check the oil level; add oil to fill — of the recommended type and viscosity. It's good "life insurance." Saves money — and new pump investment.

WAUKESHA P.D.* Sanitary Pumps are built for long life! Every detail in their design and construction confirms this. Service-conscious owners prove it every day, every year. That's why you'll find *more* Waukesha Pumps in use today for quality protection of all types of products, liquid, semi-liquid, creamy or chunky. Prove it yourself — write for latest Instruction Manual — or complete catalog.

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Waukesha 100% SANITARY PUMPS
Dependable Product of a Responsible Manufacturer

MORE POWER
cleans fouled tubes faster

WILSON
MODEL TP-301
TUBE CLEANER
offers all these features:

- More powerful
- Lighter weight—only 15 lb
- Shorter—only 13" overall
- Increased capacity—from ⅜" up to 2½" or even 3" OD tubes
- Will operate on air pressure as low as 50 lb
- Costs less than previous models

Here is the fastest, most economical tube cleaner on the market for refinery and process heat exchangers. The Wilson Model TP-301 is the only tube cleaner which can immediately remove deposits from completely plugged heat exchanger tubes. No matter how badly tubes are fouled, the Model TP-301 puts equipment back "on stream" with a minimum of manpower and a few hours work. • Use this high speed tube cleaner to step up profits, increase output and minimize downtime. •

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21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.
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Various carbide bits available
(Special Bits for Smaller Sizes)

TYPE M BIT

An inserted two lip Helix type for general use 21/64" to 1 17/32" OD.

SPE-DUR BIT

A straight flute type negative rake angle. A good three lip "chipper" for very hard deposits. 11/32" to 1 3/16" OD.

TYPE K BIT

A two lip Helix type with adaptor for general use. 1¼" to 2¾" OD.

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TW 6606A
TUBE CLEANERS • TUBE EXPANDERS

equipment free of scale made up of the heaviest of salt waters in deep wells (5000 to 8000 ft.) and to combat the corrosion of the well equipment. It is said to have proven more successful than many competitive products.

The boiler compound does not have all the components of the well treating material, and it would be impossible for the well treating compounds to be used in boilers due to the de-emulsifying agents. Therefore, this has been removed. The B compound is made up of five different chemicals of an inorganic nature. There is a liquid metal in the compound that actually blends itself in with irons and becomes a part of the metal itself. The metals in the boilers, lines, pumps, tanks, etc. are said to actually turn a very black color looking exactly like new irons.

Another chemical within the compound is reported to cause the removal of any existing scales and keeps any from being formed by the same action. This is not an acid as the pH averages about 7.4. The theory is hard to explain but it is thought that the compound, in trying to attach itself to the metal, removes any obstruction of an unstable material until it reaches stable material such as iron.—*Edward N. Jones, Consulting engineer, Box 107, Pettus, Tex.*

Copper-Clad Aluminum (A)

New markets should come of reduced costs and a wider range of sizes.

A composite metal, copper-clad aluminum, known as Alcuplate, is now being produced and marketed at prices 15 to 30 percent lower than an equivalent amount of copper or brass.

Alcuplate, while not a new product, may be considered in many fields for the first time because of larger production capacity, a wider range of sizes and new low prices.

Alcuplate, copper-clad aluminum, consists of a layer of aluminum on which a relatively thin layer of copper is clad on either one or both sides. The result is a continuous bond with a strength at least as great as that of aluminum.

In numerous applications where solid aluminum cannot be used, alcuplate provides the light weight of

"WHY DO YOU ALWAYS ORDER SOLVAY ALKALIES, JOE?"

"I'll tell you why I count on SOLVAY *FIRST* for Alkalies...

SOLVAY

Soda Ash
Caustic Potash
Chlorine
Potassium Carbonate
Calcium Chloride
Sodium Bicarbonate
Sodium Nitrite
Caustic Soda
Cleaning Compounds
Ammonium Bicarbonate
Para-dichlorobenzene
Ortho-dichlorobenzene
Monochlorobenzene
Ammonium Chloride
Snowflake® Crystals

. . . As you know, Solvay is a pretty big company. But I've always found that Solvay service has that personal touch . . . that little something that makes me feel like a valued customer, whether I buy big or small. In a nutshell, Solvay combines the service and facilities of a big company, with the friendly feeling of a small company that really has my interest at heart.

For instance—I always get courteous service from the Solvay sales staff. They always seem to be willing, even anxious, to help me. And as far as delivery is concerned, I get the same prompt delivery as the big fellows.

But probably the most important thing I get is Solvay's "Industry-Wise" Technical Service . . . a specialized, exclusive service that includes technicians who have an intimate knowledge of *my* industry. They give me advice and suggestions—and it costs me nothing.

These are the things that make me count on *Solvay first* for my alkalies."

SOLVAY PROCESS DIVISION

Allied Chemical & Dye Corporation
61 Broadway, New York 6, N. Y.

BRANCH SALES OFFICES

Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit
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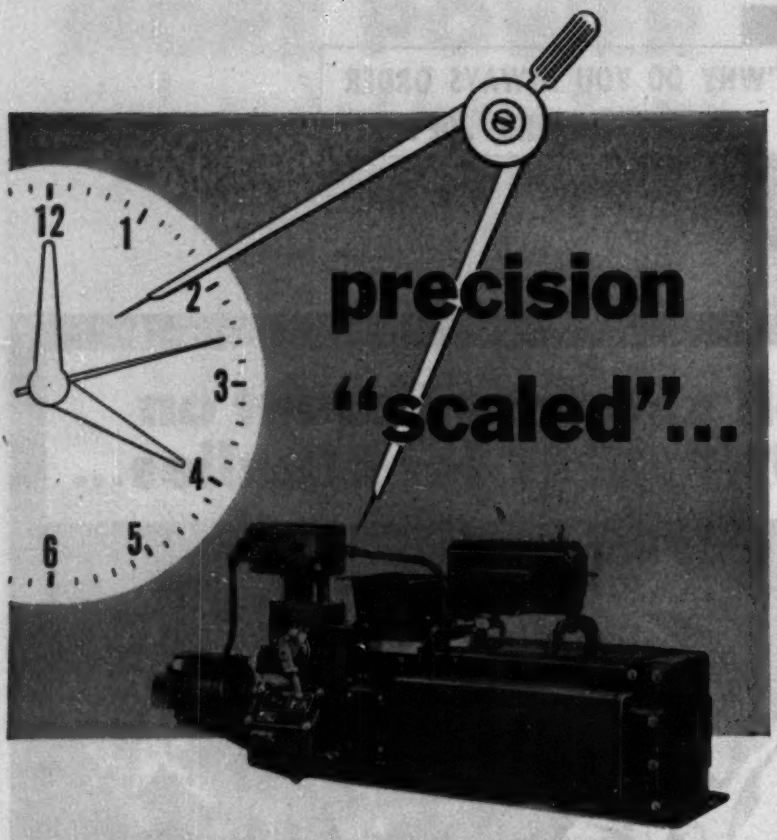

FOR MINUTE TO MINUTE ACCURACY

Minute to minute accuracy in the feeding of dry materials — uniform delivery to reaction tanks, continuous blending, or batch mixing — is a requisite for maintaining uniformly high quality in final products, in modern chemical processing operations.

W & T Merchen Scale Feeders which weigh and feed in one operation ensure this exacting accuracy. Precision "scaled", durably constructed and simply controlled, the Feeder weighs all material and immediately compensates by weight for variations in density, moisture content, etc. Whether feeding ounces or pounds per hour, the pre-set rate of feed is continually and automatically maintained.

If you have a processing problem requiring uniform feeding of dry materials, accurately controlled by weight, communicate with Wallace & Tiernan. You'll receive prompt attention without obligation.

M-21

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COMPANY, INC.
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

aluminum combined with the desirable properties of copper or brass, such as ease of soldering and ease of electroplating. Alcuplate is an excellent conductor of electricity and heat.

This composite metal is supplied in a soft condition or in the usual range of cold-worked tempers. It is sufficiently malleable to permit its successful use in intricately formed or drawn parts.

Sheet or strip is usually supplied up to ½ in. thick and up to 12½ in. wide. For applications requiring special thicknesses or widths, Aculplate can frequently be processed on request. —*Metals & Controls Corp., General Plate Div., Attleboro, Mass.*

Ketones (A)

Unsymmetrical ketones suggested as chemical intermediates, solvents, lubricants.

A series of new high molecular weight, unsymmetrical ketones are now available in limited experimental quantities.

Sample quantities of the ketones, methyl heptadecyl, methyl undecyl and methyl heptyl are now available. Made synthetically from fatty acids, it is expected that other members of the series may later be added to the list.

It is believed that they may have useful application as chemical intermediates, solvents, lubricants and plasticizers.—*Market Development Section, Armour and Co., Research Division, Chicago 9, Ill.*

(B) An intermediate super abrasion furnace (ISAF) black is now in commercial production at the Borger, Tex., plant of Philips Chemical Co. It is designed to give passenger car tire treads increased mileage under the severe conditions imposed by new and more powerful automobile engines. This new ISAF fills the gap between the company's Philblack O (HAF) black and Philblack E (SAF) black.—*Philips Petroleum Co., Bartlesville, Okla.*

(C) Three safety solvents have been developed to replace carbon tetrachloride in specialized fields of cleaning. All are said to be noncombustible, of comparatively low toxicity and close to carbon tet in speed of evaporation. None contain

petroleum hydrocarbons. They are: Cineclene M-6 for cleaning of oxygen systems and equipment; Furfasol M-17 to replace acetone and MEK in cleaning latex and resin adhesive products from process equipment, Oxylene, M-6 solvent is for cleaning of oxygen systems and equipment.—*John B. Moore Corp., P. O., Box 3, Nutley 10, N. J.*

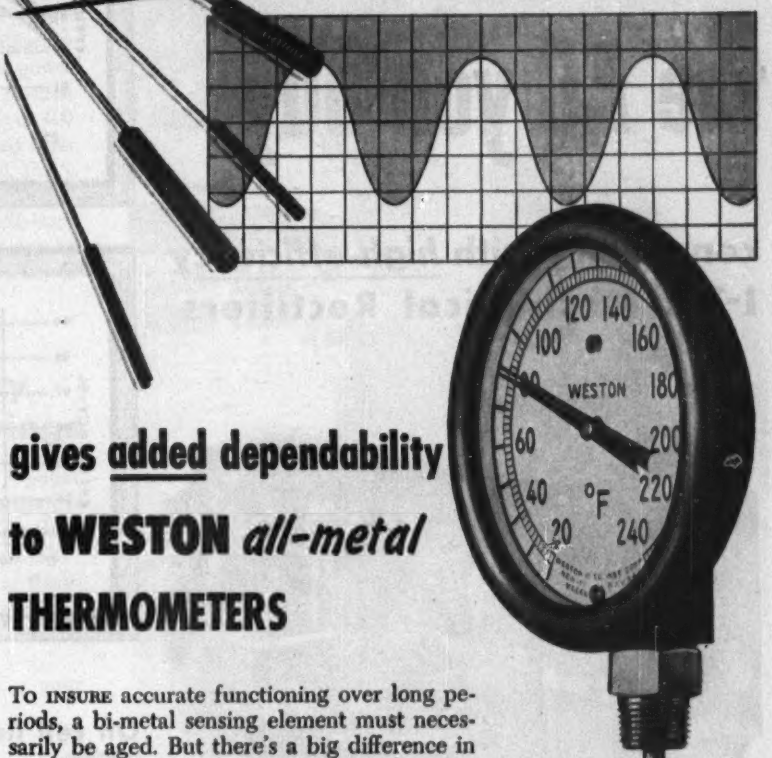
(A) **New aluminum paint** has a high pigment volume and retains itself in suspension longer than standard aluminum paste. The carefully controlled particle size distribution of the product, called MD-515, is said to provide superior covering capacity coupled with a generally coarser mesh size. These properties are said to produce paint films of brighter, more diffuse appearance. —*Metals Disintegrating Co., Elizabeth, N. J.*

(B) **New paper base laminate** is designed for application to switchgear, control equipment and other heavy electrical equipment where fire hazards exist and the mechanical and insulating properties of laminates are needed. It will burn only at elevated temperatures and is self-extinguishing in one minute or less. Called G-E 11537, it has good cold flow characteristics, low moisture absorption and retains its excellent electrical properties at temperatures up to 125 deg. C.—*General Electric, Pittsfield, Mass.*

(C) **A cleaner for motors** and electrical equipment combines low toxicity and a high flashpoint (135 deg. F.) to make it a safe replacement for carbon tetrachloride and other hazardous chlorinated solvents. Called Formula 602, it has been proven 24 times less toxic than carbon tet in laboratory tests.—*Penetone Co., 74 Hudson St., Tenafly, N. J.*

(D) **A new protective coating** or tank lining credits its epoxy resin content for superior chemical and abrasion resistance, tenacious adhesion and exceptional flexibility in the finished film. Called Erkopon, the coating is available in both air dry and baking types for brush or spray application to protect properties, installation and equipment from extremely corrosive conditions.—*Earl Paint Corp., 240 Genesee St., Utica 2, N. Y.* End

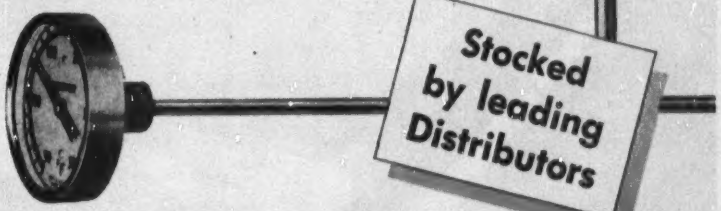
Cycle-Seasoning...



gives added dependability to WESTON *all-metal* THERMOMETERS

To INSURE accurate functioning over long periods, a bi-metal sensing element must necessarily be aged. But there's a big difference in the aging methods employed! Each element in a WESTON Thermometer is first WESTON made . . . then placed in a chamber and subjected to *broad range cycle seasoning* for prolonged periods. When finally placed in a thermometer it is *fit* and *ready* to give the precise measurements . . . the long-term dependability . . . so typical of all instruments bearing the WESTON name. WESTON Thermometers are available in all types, sizes, ranges and stem lengths for all industrial applications. Literature available . . . WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

Thermometers with the MULTIPLE HELIX



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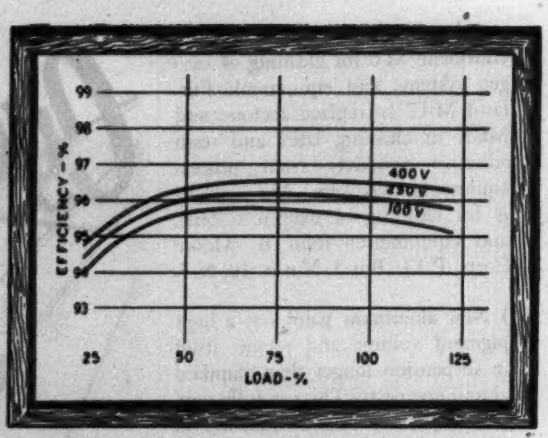
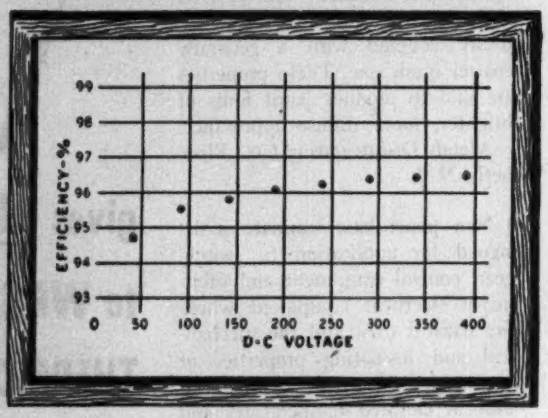
WESTON Thermometers

Get more DC from the AC you buy

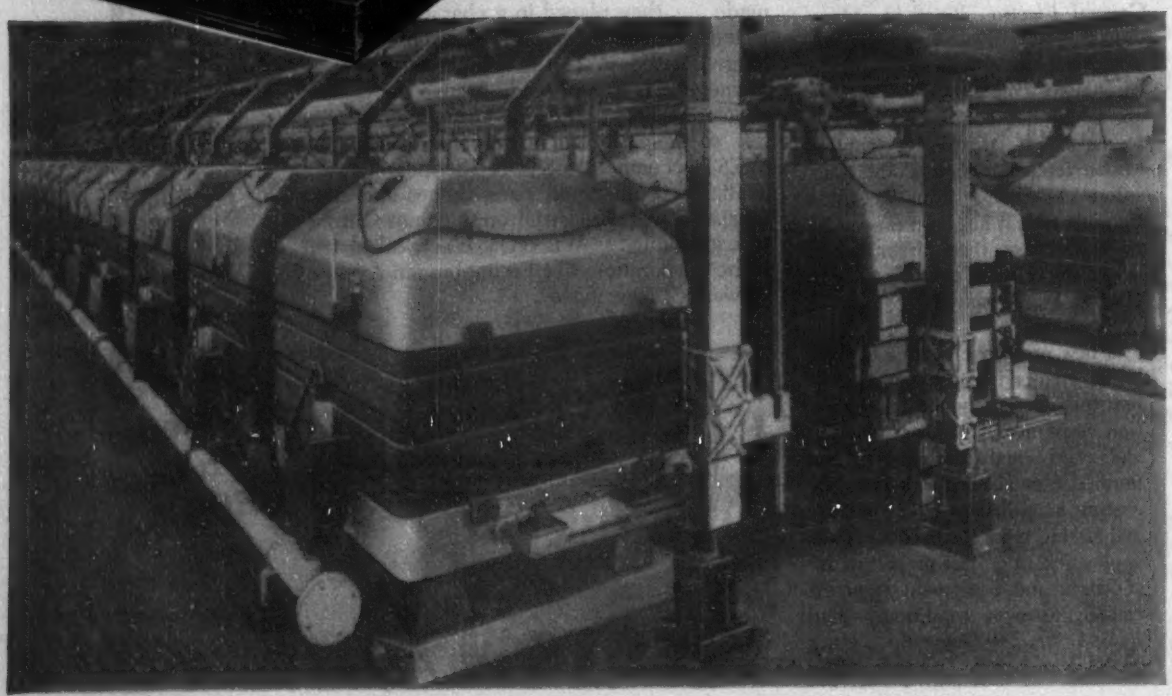
converting with *high-efficiency* I-T-E Mechanical Rectifiers





On cell lines like this—

or for heavy motor loads, metal refining, and other heavy current-using processes.



How much are you paying for lost power?

A substantial amount, probably, if you're converting AC to DC at low efficiency.

The two I-T-E Mechanical Rectifier efficiency curves, left, suggest substantial savings on power costs. 94% to 96% conversion efficiency is realized at any operating voltage, whether it's 50 volts or 400 volts. This same high efficiency is maintained from 25% to 125% of rated load current. And that's *over-all* efficiency—from a-c line to d-c bus.

In short, by converting with high-efficiency I-T-E Mechanical Rectifiers, plants can get up to 96 kwhr of direct current power for every 100 kwhr of alternating current they buy.

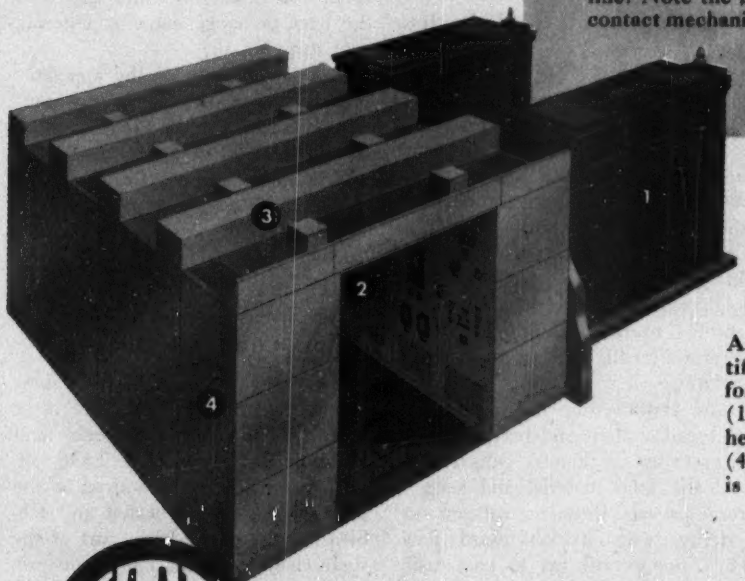
Increased efficiency means increased savings

For example: assume a 10,000 kw load, a power rate of ½ cent per kwhr, and continuous operation at 250 volts d-c. *Then*, for each 1% improvement in efficiency, yearly savings amount to *$3200 or more!*

High efficiency of the I-T-E Mechanical Rectifier (and resulting savings) are substantiated by thirty-seven units in service—more than 200,000 amperes of connected load.

For details, send for Bulletin 5205 or your nearby I-T-E Application Engineer.

10,000 ampere I-T-E Mechanical Rectifier supplying direct current to electrolytic chlorine cell line. Note the neat, compact arrangement of the contact mechanism (A) and the control panel (B).



A complete I-T-E Mechanical Rectifier installation includes: transformer and commutating reactor (1), contact mechanism (2), overhead bus (3), and d-c switchgear (4). Compact auxiliary equipment is built into compartments.

I-T-E MECHANICAL RECTIFIERS

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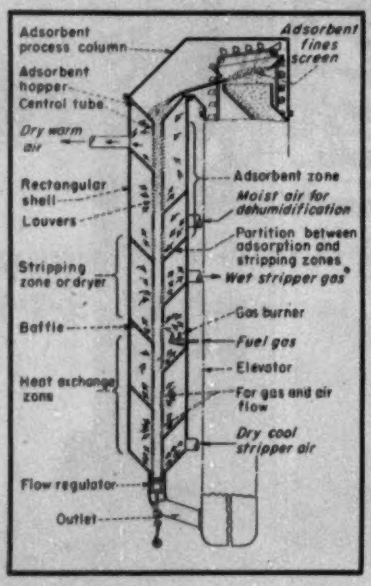
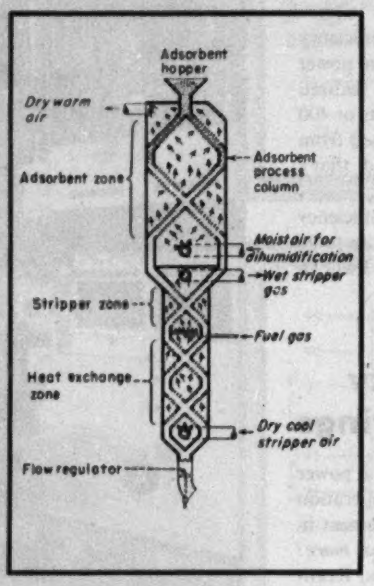
EQUIPMENT PATENTS





Cross-Flow Aids Adsorption

Latest type of continuous adsorber uses cross-flow of gas through a thin stream of falling solids to lick distribution and pressure drop problems.

Here's a new piece of equipment for continuous countercurrent contacting of solids and gases that can be used in many processes. Dehumidification of air with silica gel is illustrated in the patent, but it will work equally well in adsorption and chemical reaction processes.

According to Kenneth M. Watson, the inventor, the essential feature of his new device is the use of cross-flow of the gas through a thin stream of falling solids (see cut). He claims that this technique overcomes the difficulties in distribution of the gas and solids which are inherent in the direct counterflow methods normally used.

Also, pressure drop is greatly reduced by the cross-flow technique. This is somewhat analogous to liquid-vapor contacting in a disk-and-doughnut barometric condenser.

▶**Two Models Described**—The patent, U. S. 2,636,575, discusses two design variations. One (*left*) consists of a rectangular shell with a hopper at the top for the solid adsorbent and a central tube divided into zones and connected with the bottom outlet.

A regulating valve controls the discharge of solids from the apparatus. Solids removed from the bottom are returned to the feed hopper by an elevator after the fines are removed by screening.

The central tube has a series of solid wall sections and between these are screens or louvers which support the solid material and keep it from passing through, without interfering with its downward flow. They also permit gas to pass easily through the layer of solids. Bed thickness is normally about 2 in.

The column is divided into an adsorbent zone and a stripping zone with a partition. Other partitions or baffles are arranged alternately in order to direct the flow of gases.

The inlet for moist air being dehumidified is located at the bottom of the adsorbent zone, and the dried air outlet is at the top of the same zone. The inlet for dry cool air is near the bottom of the column while the wet stripper gas exit line is shown at the top of the stripping section. Gas burners are provided at an intermediate point and serve to heat the air and to promote drying of the solid material.

▶**Process Flow**—Cool adsorbant enters the apparatus through the feed hopper and flows into a succession of contacting zones in which the gel is supported between louvers to form a thin vertical bed. The air being dehumidified flows back and forth across the bed from the bottom to the top of the absorbent zone.

Water removed from the air is carried by the gel into the stripping zone or dryer where it is removed by contact with hot dry air. Heat for the air is provided by burning a fuel gas at the bottom of the stripping zone. The dried gel is then cooled in the heat exchange zone by entering cool stripping air.

A modified form of the apparatus (*right*) causes the solids to move from side to side while the gases move up through thin streams of absorbent. This arrangement has the advantage of providing a large cross-section of absorbent bed without excessive height.

New Spray Dryer Allows Complete Drying

Now you can improve your spray drying processes by using the dryer described by Ernest Klepetko and Philip de B. Kaye in U. S. 2,636,555. One feature of the new dryer is the provision of several heated and rabbled hearths in the lower part of the spray chamber. This innovation provides time for completing the drying process.

Another feature is that you can volatilize the liquor and then use the vapor as the gas medium in which the drying is carried out. Part of this vapor is collected, heated and

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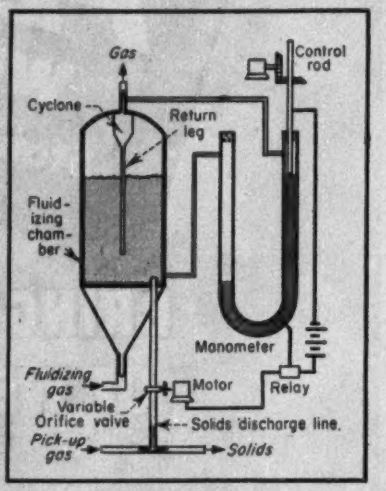
recycled for reuse in drying still more liquor. An advantage claimed for the recycle is that it avoids diluting the vapors with noncondensable or other gases, where they are to be recovered as in the case of organic vapors.

The patent is assigned to Combined Metals Reduction Co.



Novel Approach to Level Control in Fluidized Beds

A new method for maintaining a constant solids discharge rate from a fluidized bed is now available. As described by Everett Gorin, the inventor, the flow of solids is regulated by a variable orifice valve which is sensitive to changes in pressure drop across the bed.

This valve is placed in the discharge line, the size of the valve orifice being regulated by the direction of rotation of a continuously operating, reversing type motor (see cut). A manometer is used to detect the pressure drop across the bed. This is electrically connected to the valve motor through a relay, and both the manometer fluid and a control rod fitted into the low-pressure leg are conductors of electricity.

Once the desired rate of fall of the solids level is determined, the motor which advances the control rod is set to drive the rod at a corresponding rate.

Closing the rod-fluid circuit opens the valve. As the solids are discharged at an increasing rate, the level in the chamber falls and the pressure drop through the bed decreases. In the manometer, the level on the low-pres-

sure side falls, opening the switch and closing the orifice valve. When the control rod again contacts the fluid, the valve opens.

The patent, U. S. 2,636,642, has been assigned to Pittsburgh Consolidated Coal Co.

Gas-Liquid Contactor Gives High Liquid Rates

In U. S. 2,632,638, assigned to Hudson Engineering Corp., Nelson C. Turner has come up with a novel way to obtain high liquid rates in liquid-gas contacting towers. Instead of using bubble caps to pass gas up through a continuous liquid phase, Turner uses a sort of "inverted bubble cap" or trap which allows liquid to pass down from a plate to the gas space below.

The gas is forced to zigzag around the plates in a manner analogous to the flow of liquid through segmental downcomers in the conventional tower. Some loose packing is also provided between the plates in order to improve the contacting between phases.

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Now comes an electrical circuit to replace your chemical engineers, at least for multicomponent equilibrium vaporization calculations.

In U. S. 2,637,495, Frank W. Budd uses one circuit per component, a variable impedance to represent the equilibrium vaporization constant, K, of a given compound, and other variable impedances to represent the mol fraction of the component in the feed and the fraction of the feed vaporized. Phillips Petroleum Co. is the instigator (technically the assignee) of this "shocking" invention.

For Keeping Posted . . .

This department is a digest of recently issued patents selected and evaluated for you by Melvin Nord, 664 Putnam, Detroit 2, Mich. You can get copies of any patents, including those mentioned here, by ordering from the Commissioner of Patents, Washington 25, D. C. They cost 25¢ each. Do not send stamps.

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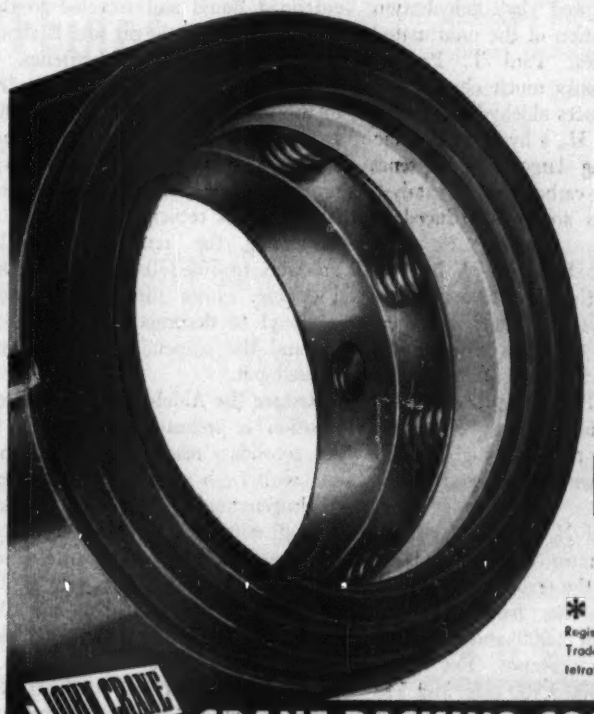
describing the John Crane Type 9 Shaft Seal. Crane Packing Co., 1809 Belle Plaine Ave., Chicago 13, Illinois.



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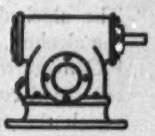

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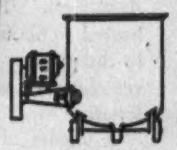

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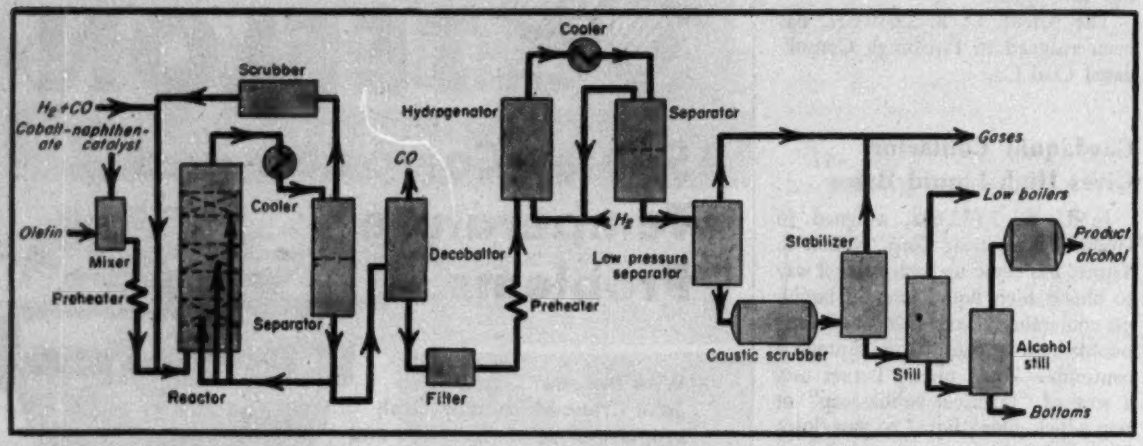

New Process for Octyl Alcohols

Start off with carbon dioxide, hydrogen and a heptene cut, adjust conditions, add a catalyst and wind up with octyl alcohol. Here's how it's done.

Joining the swing to high pressure, catalytic processes is this new approach to octyl alcohol manufacture. Normally these alcohols are produced by such comparatively costly procedures as aldol condensation of butyraldehydes, followed by dehydration and hydrogenation of the unsaturated octyl aldehydes. Paul T. Parker's new process looks much cheaper.

Parker produces aldehydes by interaction of CO, H_2, a hydrocarbon fraction consisting largely of heptenes and a cobalt carbonylation catalyst. The aldehydes are then reduced to the alcohols.

▶**Convert the Heptenes**—A heptene cut is fed continuously to a mixer in which the catalyst, cobalt naphthenate, is added to attain a concentration of about 0.2 percent cobalt (see flowsheet). The mixture is then heated to about 500 deg. F. and sent to the primary reactor, a high-pressure vessel packed with a non-catalytic material.

A stream of H_2 and CO synthesis gas (volume ratio 1.0-1.2:1.0) is introduced into the reactor concurrently with the heptenes feed. Gas flow ranges between 2,000 and 3,000 cu. ft. per bbl. of heptenes. The reactor operates at 3,000-3,500 psig. and 340-360 deg. F., with a residence time of about 2.5 hours. Reactor temperature control is maintained by recycling a portion of the product.

Liquid oxygenated reaction products, containing dissolved catalyst and unreacted gases, are then cooled. The gases are separated, scrubbed free of entrained liquid and recycled to the reactor. The recycle gas rate is about 6,000 cu. ft. per bbl. of heptenes.

A portion of the liquid is recycled to the reactor and injected at various levels to obtain close temperature control throughout the reactor. Approximately 400-500 percent of the fresh feed is recycled.

Heating the remainder of the products to 300-350 deg. F. at 100-150 psig. causes the soluble cobalt carbonyl to decompose, CO passing off and the suspended cobalt being filtered out.

▶**Reduce the Aldehydes**—The filtered solution is preheated and passed to the secondary reactor, the hydrogenator, with fresh and recycle hydrogen. Hydrogenation reactions are carried out at 400-500 deg. F. and 2,800-3,200 psig. in the presence of a nickel catalyst. The liquid feed rate is 0.6 volumes/unit volume/hour and the recycle gas rate is 15,000 cu. ft./bbl. of hydrogenator feed.

The hydrogenation products are then cooled and separated, the unreacted hydrogen recycled and the liquid sent to a low pressure separator to flash off dissolved gases. Liquid from the separator is scrubbed with caustic and stabilized, removing any remaining gases.

The stabilized liquid is then furthem distilled to remove low boilers (mostly hydrocarbons boiling under 340 deg. F.). These low boilers may be used as gasoline blending agent. Bottoms are sent to an alcohol still to obtain an octyl cut (350 to 375 deg. F.). The bottoms from the alcohol still may be used as cracking stock or fuel, or they can be processed further to recover valuable oxygenated compounds.

The patent, U. S. 2,637,746, has been assigned to Standard Oil Development Co.

New Catalytic Reforming Method Yields Aromatics

Relatively high-purity toluene can now be made by catalytically reforming naphthas. Alex G. Oblad and George A. Mills describe the new process in U. S. 2,636,909, assigned to Houdry Process Corp.

First you take a heart cut from the naphtha, boiling about 10 deg. F. above and below the boiling point of toluene (200 deg. F.). The rest of the naphtha is then reformed and a fraction boiling in the range 220-240 deg. F. is taken from the reformate.

Upon redistillation, this fraction will contain 90-95 percent toluene, since most of the non-aromatic hydrocarbons boiling in the toluene range were removed in the original heart cut. Benzene and xylene fractions

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are also recovered from the other fractions of the reformate.

The improvement in toluene purity is partly offset by the loss of some toluene in the heart cut. This is relatively minor, however, since the cut is only 10-15 percent of the initial naphtha.

How To Use a Turbine As a Chemical Reactor

Chemical reactions can be conducted in a turbine, says John W. Latchum, Jr. in U. S. 2,632,689, assigned to Phillips Petroleum Co. The turbine not only acts as the reaction chamber, but also develops power from liberated reaction energy at the same time.

The method is applicable to chemical processes involving high pressures, high-temperature gas or vapor-forming reactions of the exothermic type. It can also be used for processes in which the volume of reaction products is greater than the volume of reactants. Latchum gives several examples in the patent, with particular emphasis on the formation of hydrogen fluoride from hydrogen and fluorine.

How to Separate Methanol From Methyl Acetate

Methanol can be separated from methyl acetate by extractive distillation with etylene glycol. So claim Raymond I. Hoaglin and Walter M. Frankenberger. Their patent, U. S. 2,636,050, is assigned to Union Carbide & Carbon Corp.

Methanol boils at 64.5 deg. C. and methyl acetate at 57.2 deg. C.; together they form an azeotrope boiling at 54 deg. C. If ethylene glycol is introduced near the top of the distillation column, however, it flows down the column, preferentially absorbing methanol. The methyl acetate, freed of methanol, passes overhead.

The methanol is removed from the bottom of the column with the ethylene glycol, and is recovered by simple distillation, the glycol returning to the extractive distillation column.

With a rectifying column of 23 theoretical plates and a ratio of 2.5 volumes of the glycol to each volume of feed mixture, 99 percent of the methyl acetate was obtained as a distillate with 98-99 percent purity.

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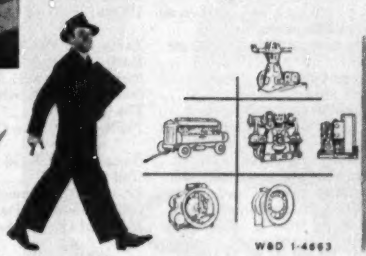

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Your Checklist of New Equipment Patents

Operation . . .	About . . .	Inventor or Assignee . . .	Patent No. . .
Adsorption	Continuous selective adsorber	Phillips Petroleum Co	2,635,706
	Fixed bed cyclic adsorber	Phillips Petroleum Co	2,635,707
	Fluidized selective adsorption separation process for producing three or more fractions	Phillips Petroleum Co	2,636,574
Centrifugal separation	Centrifugal separation using an auxiliary liquid	Aktiebolaget Separator	2,636,670
	Sealing means for feed and discharge conduits of centrifugal separator bowls	The Sharples Corp	2,637,491
	Centrifugal deaerator for liquids	The Sharples Corp	2,634,907
Chemical Reaction	Pebble heating and reaction chamber	Phillips Petroleum Co	2,635,864
	Fluidizing solids using mechanical vibrators to supply part of the energy	Standard Oil Development Co	2,635,949
	Apparatus or stripping fluid-type catalysts	Phillips Petroleum Co	2,637,633
Crushing and Grinding	Centrifugal impact pulverizer	Paramount Mining and Milling Co	2,634,915
	Gyratory crusher	Nordberg Mfg. Co	2,635,818
	Yieldable pitman for jaw crushers	Allis-Chalmers Mfg. Co	2,636,690
	Pocksted hammer rotor for pulverizing machines	Allis-Chalmers Mfg. Co	2,637,502
Distillation	Engine-driven vapor compression distillation	Badger Mfg. Co	2,637,684
Drying	Rotary drier for completing the drying of granular materials	Baker Perkins, Inc	2,634,512
	Spray drier and cooler	Gerald D. Arnold	2,634,908
	Double drum drier	Beech-Nut Packing Co	2,635,353
Filtration	Wire-tensioner for continuous rotary drum filters	The Lummus Co	2,636,611
	Horizontal rotating screen filter	United States of America	2,636,612
	Rotary pan filter	The Eimco Corp	2,637,443
Fluid and Particle Transfer	Controlling the discharge rate of liquid suspensions from containers	De Directie van de Staatsmijnen in Limburg	2,634,741
	Fixed bed catalyst draw-off	Socony-Vacuum Oil Co	2,635,071
	High-vacuum pump, method and techniques	Elmer A. Hertsler	2,636,664
	Slide valve for regulating flow of solids	Standard Oil Development Co	2,636,712
	Disengagement of gas from fluent solid particles	Houdry Process Corp	2,636,905
	Apparatus for conveying dry solids in air	John M. Crom	2,637,539
Gas-solids Separation	Electrical precipitator for gas cleaning	Research Corp	2,634,816
	Dust removal from walls of a collecting device	National Lead Co	2,636,573
Heat Transfer	Pebble heat exchanger	Phillips Petrolum Co	2,635,990
	High-temperature melting furnace	The Babcock & Wilcox Co	2,636,723
	Air-heating furnace with forced downward air flow	Petro-Chem Process Co	2,637,314
Instrumentation and Control	Automatic freezing point measurer and recorder	Dow Chemical Co	2,635,455–6
	Melting point recorder	Bendix Aviation Corp	2,635,457–8
	Continuous density meter for gases or liquids	Foster M. Poole	2,635,462
	Magnetic flowmeter	Phillips Petroleum Co	2,637,207
Mixing	Mixing tank	Felix W. Dreyfus	2,635,859
	Centrifugal mixing device	Premier Mill Corp	2,635,880
	Agitating impeller	Allis-Chalmers Mfg. Co	2,636,720
	Agitating apparatus	Mixing Equipment Co., Inc	2,637,538
Screening	Parallel motion translator for vibratory screens	Allis-Chalmers Mfg. Co	2,635,752
	Rock deck vibratory screen	Allis-Chalmers Mfg. Co	2,636,607
Solid-solid Separation	Air suspension separation of granular mixtures	William H. Mead	2,635,745
	Magnetic separator	R. H. Stearns and R. N. Stearns	2,634,861
Water Cooling	Baffle trays for forced draft cooling tower	John R. Cave	2,634,959
	Mechanical draft cooling tower	The Fluor Corp., Ltd	2,636,371

. . . And New Process Patents

Product . . .	Process . . .	Inventor or Assignee . . .	Patent No. . .
Agricultural Chemicals	Beta-halo propionic acids and derivatives as plant growth regulants	The B. F. Goodrich Co	2,636,816
Carbon Black	Manufacture of pelletized carbon black	Godfrey L. Cabot, Inc	2,635,037
Catalysts	Reactivating a supported platinum catalyst	Universal Oil Products Co	2,635,080
	Molybdenum sulfide on a spent cracking catalyst	Sun Oil Co	2,635,081
	Activation of a chromia-alumina catalyst	Socony-Vacuum Oil Co	2,635,082
	Regeneration of hydrocarbon synthesis catalysts	The Texas Co	2,635,110
	Reactivation of conversion catalysts	Standard Oil Development Co	2,636,845
	Manufacture of alumina-platinum catalysts	Universal Oil Products Co	2,636,863
	Supported $MgCl_2$–$CuCl_2$ catalyst	Dow Chemical Co	2,636,864
	Electrostatic separation of active from inactive inorganic oxide catalysts	Standard Oil Co. (Ind.)	2,635,749
	Making and regenerating Fischer-Tropsch catalyst	Phillips Petrolum Co	2,636,011
	Supported catalyst for hydrogenation of CO	The M. W. Kellogg Co	2,637,739
Coke By-products	Removal of phenol from contaminated NH_3 liquors	Jones & Laughlin Steel Co	2,635,073
Fats and Oils	Recovery of fatty acid values from aqueous liquids	F. S. Gibbs, Inc	2,637,737
	Fractionation of cat oil	The Quaker Oats Co	2,636,888
	Preparation of peroxides of unsaturated fatty acids	Regents of the Univ. of Minnesota	2,636,890
Gases	Recovery of HCN from gas mixtures by adsorption	Union Oil Co. of Calif	2,634,817
	Absorption of HCN from gas mixtures	Dow Chemical Co	2,634,823–5
	Separation of CO_2 and NH_3	Inventa A-G. Fuer Forschung & Patentverwertung	2,634,826
	Production of hydrogen by coking a hydrocarbon oil in the presence of fluidized iron oxide	Union Oil Co. of Calif	2,635,947
	Production of high-purity hydrogen from waste gas	Eastman Kodak Co	2,635,948
	Polymerizing oxygen	Edmund J. Ryan	2,637,683
Hydrocarbons	Electrothermal production of shale oil	Svenska Skifferolje Aktiebolaget	2,634,961
	Adsorption of olefins from propane by coke	Standard Oil Development Co	2,635,709
	Separation of wax-like constituents with urea	The Texas Co	2,635,966
	Catalytic conversion of shale oil hydrocarbons to a gasoline fraction	Phillips Petroleum Co	2,635,987
	Catalytic hydrocarbon conversion process	Socony-Vacuum Oil Co	2,635,988
	Catalytic conversion of mixed liquids and vapors	Gulf Oil Corp	2,635,989
	Polymerization of olefins in an annular reactor	Standard Oil Development Co	2,636,026
	Preparation of hydrocarbon mixtures for oxidation	Gulf Research & Development Co	2,636,047
	Recovery of cyclopentadiene from a cracked petroleum naphtha	Standard Oil Development Co	2,636,054–5

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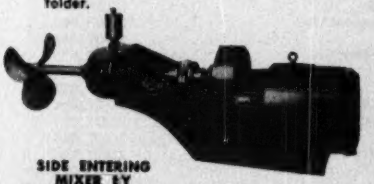

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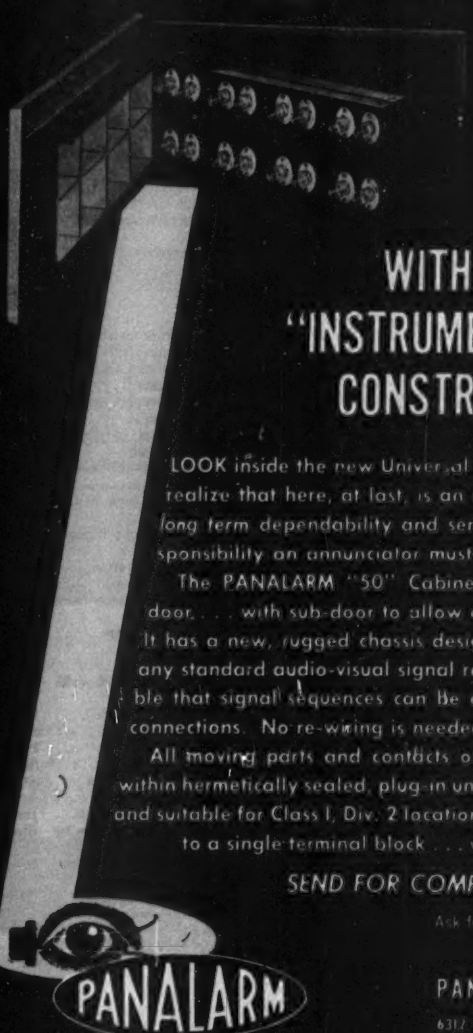
OPENS THE DOOR

TO MORE DEPENDABLE ANNUNCIATOR PERFORMANCE



WITH NEW "INSTRUMENT-TYPE" CONSTRUCTION

LOOK inside the new Universal PANALARM "50". You will realize that here, at last, is an annunciator system built for long term dependability and service. Built to match the responsibility an annunciator must assume in your plant.

The PANALARM "50" Cabinet has a substantial hinged door . . . with sub-door to allow easy access to signal lamps. It has a new, rugged chassis design . . . pre-wired to handle any standard audio-visual signal requirement . . . and so flexible that signal sequences can be changed by simple terminal connections. No re-wiring is needed.

All moving parts and contacts of the PANALARM "50" are within hermetically sealed, plug-in units. They are corrosion-proof and suitable for Class I, Div. 2 locations. All connections are made to a single terminal block . . . with ample space for wiring.

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PANALARM

PANALARM PRODUCTS, INC.
6312 North Broadway, Chicago 40, Illinois

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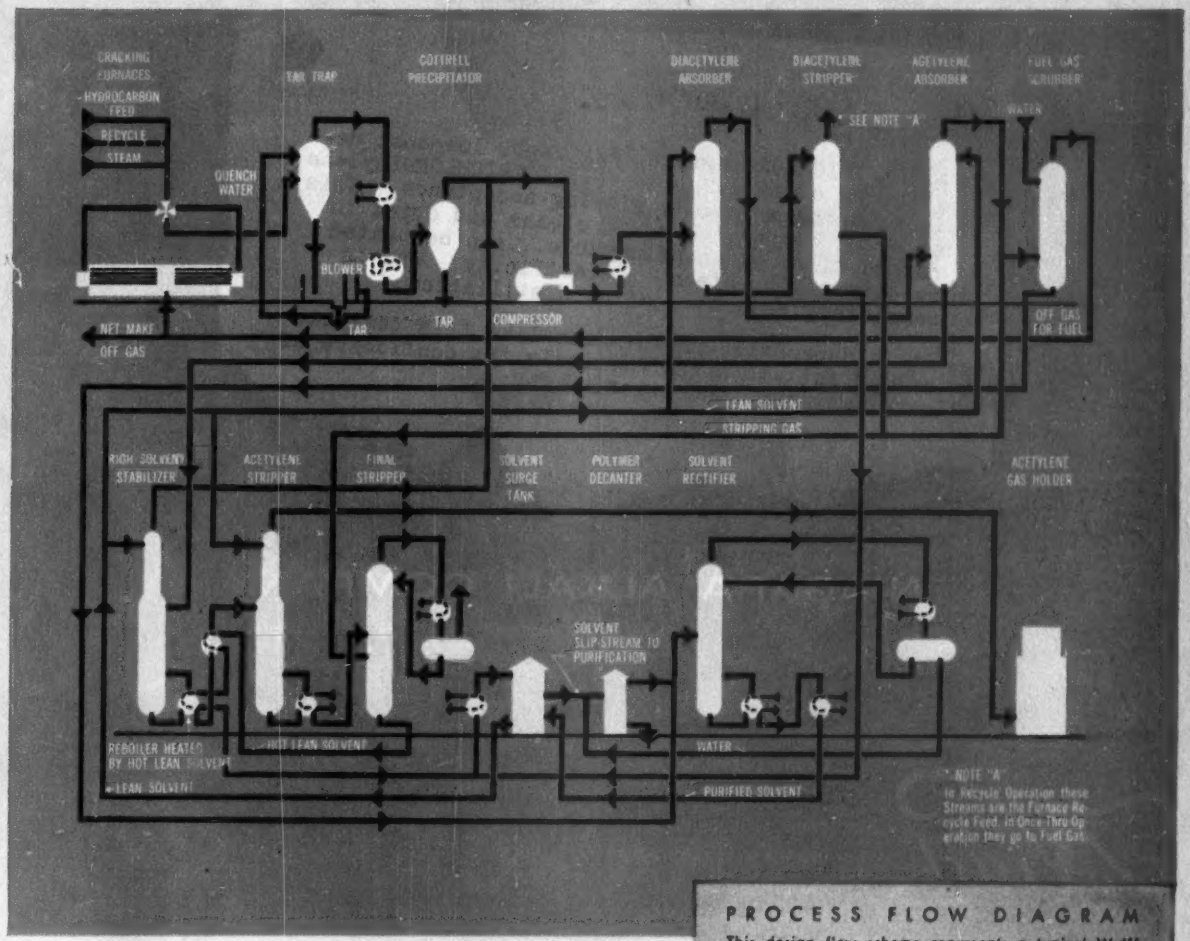
Product . . .	Process . . .	Inventor or Assignee . . .	Patent No. . .
	Desulfurization of heavy petroleum oils	Standard Oil Development Co	2,636,841
	Distillation of sweetened petroleum distillates	Standard Oil Development Co	2,636,842
	Cracked naphtha desulfurization	Standard Oil Co. (Ind.)	2,636,843
	Conversion of reduced crudes with naphtha diluent	Standard Oil Development Co	2,636,844
	Photochemical production of branched paraffins and naphthenic hydrocarbons	Standard Oil Development Co	2,636,853-4
	Selective removal of acetylene from hydrocarbons	Phillips Petroleum Co	2,636,911
	Fractional separation of wax from a hydrocarbon mixture with urea or thiourea and a solvent	The Texas Co	2,637,687
	Distillation of oil shale	Universal Oil Products Co	2,637,683
	Purification of cyclohexane	Phillips Petroleum Co	2,637,749
Inorganic Chemicals	Preparation of uranium bromide	Atomic Energy Comm	2,635,035
	Preparation of zirconium tetrafluoride	Atomic Energy Comm	2,635,037
	Spray drying to make caustic soda granules	Imperial Chemical Industries, Ltd	2,635,684
	Production of granular beryllium fluoride	Atomic Energy Comm	2,635,944
	Making KNO_3 from wyomingite and sodium nitrate	Robert D. Pike	2,635,945
	Preparation of powdered thorium	Atomic Energy Comm	2,635,956
	Electrolytic production of chromium hydride	Batelle Development Corp	2,635,993
	Rare-earth separation by anion exchange	Atomic Energy Comm	2,636,044
	Manufacture of CaF_2 and H_3PO_4 from phosphate rock by action of hydrofluosilicic acid and water	Tennessee Corp	2,636,806
	Purification of calcium chloride	General Electric Co	2,636,807
	Process for stabilizing red phosphorus	George F. Nordblom	2,636,811
	Deposition of colloidal sulfur on carbon black	Phillips Petroleum Co	2,636,831
	Making alumina from higher alcoholates of aluminum	Standard Oil Development Co	2,636,865
	Manufacture of magnesia and calcium carbonate	Max Hleguet	2,637,545
	Production and separation of anhydrous alkali metal sulfate and boric acid	Borax Consolidated, Ltd	2,637,626
	Preparation of raw sulfite acid	Gustaf Haglund	2,637,627
	Beneficiation of alumina	I. De Vecchis, O. E. Ramus, and G. H. Montmartin	2,637,628
	Method of burning sulfur	Mathieson Chemical Corp	2,637,630
	Production of ferrosilicon	Marvin J. Udy	2,637,648
	Method for producing barium salts	Barium Development Co	2,637,700
Organic Chemicals	Purification of amyl alcohols	Stanolind Oil & Gas Co	2,635,072
	Emulsion polymerization process	Monsanto Chemical Co	2,635,086
	Manufacture of tetra-alkyl lead compounds	Ethyl Corp	2,635,105-7
	Production of aminomethyl-phosphonic acid cpds	Research Corp	2,635,112
	Preparation of amine nitrates	John K. Wolfe and Kenneth L. Temple	2,635,116
	Preparation of polychloro-acetones	Allied Chemical & Dye Corp	2,635,117-8
	Conversion of olefins to ketones	Shell Development Co	2,635,119
	Obtaining purified phenols and cresols from oil	Standard Oil Co. (Ind.)	2,635,120
	Dehalogenation of organic fluorine compounds	Allied Chemical & Dye Corp	2,635,121
	Separation and purification of alcohols by extractive distillation	Standard Oil Development Co	2,635,992
	Production of trialkyl phosphate esters	Victor Chemical Works	2,636,048
	Production of n- and iso-propyl methacrylate	Imperial Chemical Industries Ltd	2,636,049
	Preparation of diamine	Shell Development Co	2,636,051
	Making purified aqueous formaldehyde by extraction	Celanese Corp. of America	2,636,053
	Catalytic dehydration of alcohols to olefins	Phillips Petroleum Co	2,636,057
	Manufacture of CS_2 from natural gas	Food Machinery and Chemicals Corp	2,636,810
	Manufacture of cellulose ethers	E. I. du Pont de Nemours and Co	2,636,879
	Production of ethylenimines	United States of America	2,636,880
	Preparation of 3-pyrodols from 2-acylfurans	The Quaker Oats Co	2,636,882
	Preparation of thienyl ketones	Union Oil Co. of Calif	2,636,883
	Preparation of 1, 3-dioxo-lane derivatives	Nopco Chemical Co., Inc	2,636,884
	Production of metal oxalates	International Standard Electric Corp	2,636,892
	Preparation of alkyldihalo-arsine	United States of America	2,636,893
	Preparation of alkyldihalo-stibine	United States of America	2,636,894
	Preparation of organohalo-silanes	General Electric Co	2,636,895
	Manufacture of oxidation products from unsaturated organic compounds by means of nitrous oxide	Imperial Chemical Industries, Ltd	2,636,898
	Oxidation process for making terephthalic acid	E. I. du Pont de Nemours and Co	2,636,899
	Purification of ortho-hydroxy-benzamide	Aschaffenburger Zellstoffwerke	2,636,900
	Reduction of nitro-olefins	Commercial Solvents Corp	2,636,901
	Production of amines	Imperial Chemical Industries, Ltd	2,636,902
	Making oxygenated cpds. by reaction of olefinic carbon cpds. with H_2 and CO catalytically	Standard Oil Development Co	2,636,903-4
	Conversion of ethylene oxide to valuable products	American Cyanamid Co	2,636,906
	Fluorination of halocarbons	The M. W. Kellogg Co	2,636,907-8
	Removal of organic fluorine impurities from hydrocarbons	Phillips Petroleum Co	2,636,912
	Polymerizing isobutylene in the presence of n-butenes and ether	Standard Oil Development Co	2,637,720
	Protection of alcoholic steroid hydroxyl groups	The Upjohn Co	2,637,728
	Manufacture of pyrazolones	Ciba Ltd	2,637,732
	Manufacture of high molecular weight ester from oleic acid and isopropyl alcohol	Standard Oil Development Co	2,637,736
	Reaction of silanes with aliphatic unsaturates	Union Carbide & Carbon Corp	2,637,738
	Preparation of diketones	Monsanto Chemical Co	2,637,742
	Extraction of naphthenic acids	Sun Oil Co	2,637,744
	Manufacture of halogenated aryl alicyclic carboxylic acids and their salts	Schering International Research Inst	2,637,745
	Fluorination of saturated aliphatic compounds	Purdue Research Foundation	2,637,747
	Manufacture of fluoro-organic compounds	Allied Chemical & Dye Corp	2,637,748
	Making monoalkyl aromatic hydrocarbons	Phillips Petroleum Co	2,637,750
Pigments	Making finely divided metallic oxide pigments	Sauerefabrik Schweizerhall	2,635,946
Resins	Filter purifying of synthetic hydrocarbon resins	Standard Oil Development Co	2,636,016
	Way to make vinyl chloride resin dispersions	Arthur D. Little, Inc	2,636,871-2
	Preparation of resinous aromatic polyphosphates	Imperial Chemical Industries, Ltd	2,636,876
	Process for drying granular vinyl ester polymers by azeotropic distillation	Shawinigan Chemicals, Ltd	2,637,119
	Production of oil-modified alkyd resins from degummed soybean oil and monopenta-erythritol	Monsanto Chemical Co	2,637,707-8
Rubber	Manufacture of chloroprene	Ethyl Corp	2,635,122
	Vulcanization of rubber	United States Rubber Co	2,635,124
	Chlorinating natural rubber	Rubber and Asbestos Corp	2,637,753

NOW—ACETYLENE FROM HYDROCARBON FEED via the Wulff Process

With heavy demands for the hundreds of petrochemical end products that may be synthesized from acetylene, the need for low-cost acetylene as a raw material is becoming urgent. The Wulff Process now answers this need with a high purity acetylene at the lowest cost ever offered by any process. Any petroleum hydrocarbon conveniently vaporizable can be used as a feed stock. Recent operations of the Wulff Process have proved it to be technically sound and commercially attractive. If your plant is convenient to a source of natural gas, ethane, propane, etc., it will pay you to investigate the possibilities of manufacturing acetylene economically by the Wulff Process.



PROCESS FLOW DIAGRAM

This design flow scheme represents a typical Wulff Process plant for producing low-cost acetylene at 99+ volume percent purity from natural gas or propane. Two basic steps are involved: cracking of hydrocarbons to produce acetylene in a mixture of gases, and recovery and purification of the dilute product contained in the cracked mixture. Feed hydrocarbon is cracked in regenerative type furnaces heated by air-combustion of off-gas from the recovery section. No oxygen plant is required. The recovery and purification section is of conventional design operating at moderate temperatures and pressures. Only a single inexpensive readily-available solvent need be used. Operation is continuous and virtually automatic, requiring a minimum of operating personnel. Power demands are moderate, maintenance costs are low, hazards are negligible and there is practically no waste disposal problem.

The Wulff Process is available through Fluor, a name famous in process design, engineering and construction for the petroleum and chemical industries. For information on recent developments in this field, write for Bulletin EC-PA-0.002.

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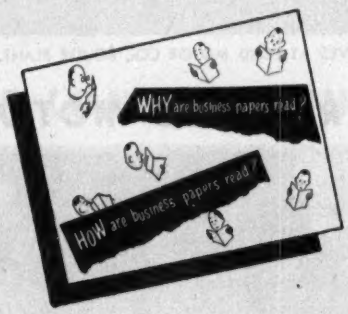

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The Flow Tube is available in types and D/d ratios to handle a wide range of fluids and main line velocities. This flexibility enables you to use the one Flow Tube that will produce differentials that can be accurately measured, with the least head loss.

Flow Tubes have many other plus values—they're compact, comparatively light weight, and are easy to install since they require minimum straight runs entering and following. All Flow Tubes are furnished with head-capacity curves obtained in laboratory tests and can therefore be guaranteed as to accuracy.

That's why Flow Tubes are being successfully used in scores of installations metering the flow of liquids and wet or dry gases. Available in all pipe sizes and suitable metals. They can be furnished with or without suitable secondary indicating, recording or totalizing instruments. For further information, write for Bulletin FT102. For specific recommendations, send us necessary flow data.

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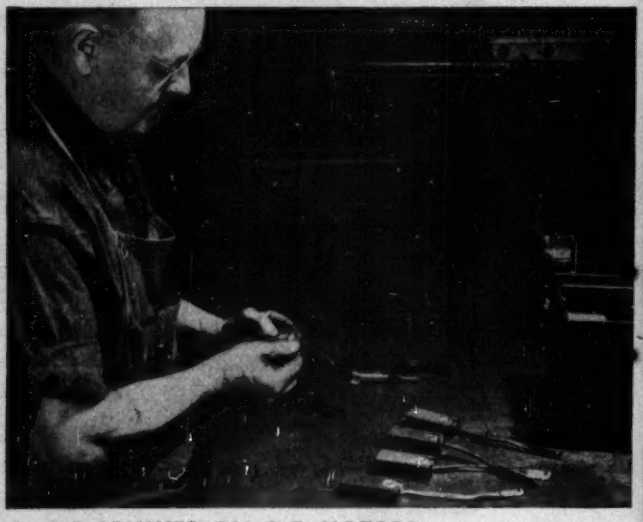
ONE OF FIVE 2000-HP G-E SYNCHRONOUS MOTORS USED FOR AIR-COMPRESSOR DRIVES AT FORD MOTOR CO., ROUGE PLANT.

FOUR REASONS WHY G-E SYNCHRONOUS MOTORS

1. STRONG, FABRICATED FRAMES . . .

The welded steel-plate stator frame provides maximum rigidity in a comparatively lightweight construction. The sturdy channel-shaped frame consists of a wrapper plate firmly secured by continuous welds to rigid side plates. This design, proved by years of operating experience, affords more than ample strength for clamping and supporting the stator core.



2. G-E BRUSHES ON G-E MOTORS . . .

Brushes on G-E synchronous motors are a product of G-E teamwork. Close co-operation between machine designers and laboratory engineers means you get the right brush on the right motor for your particular application. In addition to extensive research and testing, all new and improved grades of brushes are thoroughly field-tested before approved for standard use.

Dependable G-E Synchronous Motors on 24-Hour Assembly-line Service

Ford Motor Company uses G-E synchronous motors for air-compressor drives

Compressor-motor dependability is really put to test on 'round-the-clock service at Ford Motor Company's Rouge plant. Compressed air is used 24 hours a day on many assembly operations, and a dependable supply is vital to keep production lines moving.

To furnish this all-important air, five 2000-hp G-E synchronous motors drive reciprocating compressors continuously—with only slight reductions in demand on certain shifts.

G-E synchronous motors can be relied upon for such continuous service with minimum downtime. You can depend on them because in back of every G-E synchronous motor stand more than half a century of motor engineering leadership . . . superior research and testing facilities to assure excellent component materials . . . and a corps of experienced craftsmen who are proud of the equipment they build—and build it to last.

The next time you consider a drive for heavy, continuous-service equipment be sure to call in your G-E representative to discuss any special application problem you may have. Have him explain the many money-saving uses for G-E synchronous motors and point out their operating economies.

In the meantime, you can obtain more information on G-E synchronous motors by writing for these publications: GEA-5332, "Low-speed Synchronous Motors," or GEA-5426, "High-speed Synchronous Motors." Write to Section 770-29, General Electric Co., Schenectady 5, N. Y.

You can put your confidence in—

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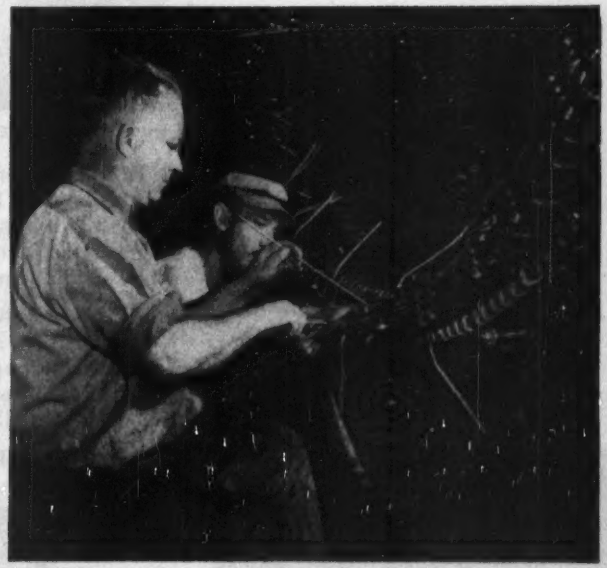
GIVE LONG, DEPENDABLE SERVICE . . .

3. LONG INSULATION LIFE . . .

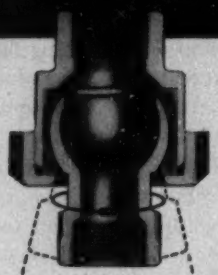
Insulating materials, manufactured in our own factories by the most modern methods, conform to rigid G-E specifications and are applied by experienced operators, above. Thus coils are uniform, interchangeable, mechanically rugged, and moisture resisting.



4. LOW-RESISTANCE CONNECTIONS . . .

For dependable operation, stator windings are silver brazed, as shown above. Joints of this type have low electrical resistance, exceptional thermal and mechanical strength. These important properties are difficult to obtain by other methods.

BARCO Flexible BALL JOINTS



1. **MAXIMUM FLEXIBILITY.** Up to 40° side flexibility with 360° rotating movement.
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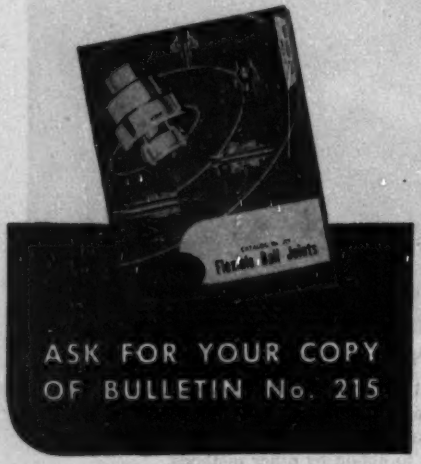
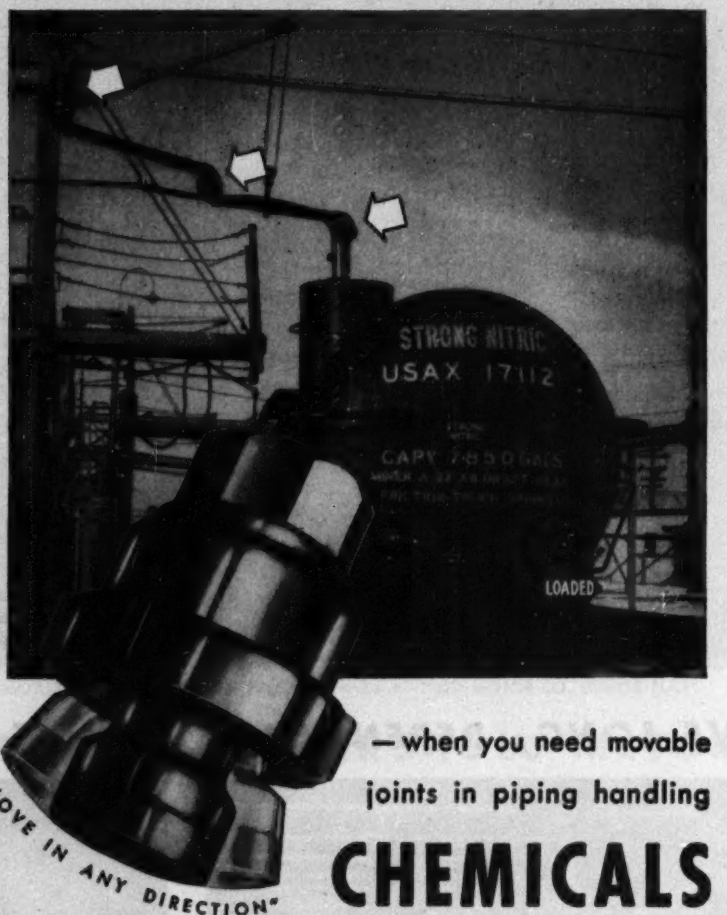
3. **NO METAL-TO-METAL CONTACT BETWEEN MOVING PARTS.** An important Barco advantage where corrosive chemicals are present, either externally or internally.
4. **STAINLESS STEEL BODIES.** Also regularly furnished in Malleable Iron, Steel, Bronze, Aluminum, and Magnesium. Other special alloy joints to order.
5. **PRESSURE-SAFE! FIRE-PROOF!** Unequalled for SAFETY where flexible connections are required.
6. **MANY STYLES AVAILABLE.** Angle or straight; threaded or flanged connections. For pressures to 6,000 psi; temperatures to 1000°F. 15 different sizes, ¼" to 12".





— when you need movable joints in piping handling

CHEMICALS

THE above photograph shows BARCO BALL JOINTS used to provide flexibility in Nitric Acid Tank Car Loading Lines at the Joliet, Ill., Arsenal. This is but one of many installations in the chemical industry where Barco joints are used to allow movement in piping conveying acids, alkalies, and solvents — as well as steam, air, oil, gas, or water.

BARCO BALL JOINTS offer many advantages over ordinary types of joints or flexible connections. When you want to be sure of getting SAFE, long-lasting, trouble-free installations, specify BARCO! Ask our engineers for recommendations. Worldwide Sales and Service. BARCO MANUFACTURING Co., 516J Hough St., Barrington, Illinois.
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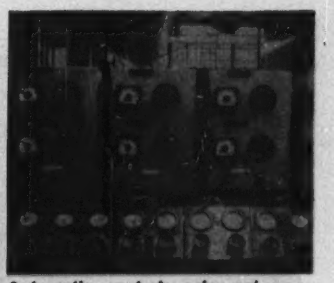
THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING, AND REVOLVING JOINTS

Block-long Fourdriniers sitting side by side turn out an endless strip of kraft 24 hours per day, 7 days per week, 365 days per year. At "wet end" above, kraft is 96% water, 4% pulp. Scene is at modern Florida mill where Hudson Multiwall Sacks are made.



Automatic controls safeguard every foot of kraft manufacture, to assure that your exacting specifications are fully met.

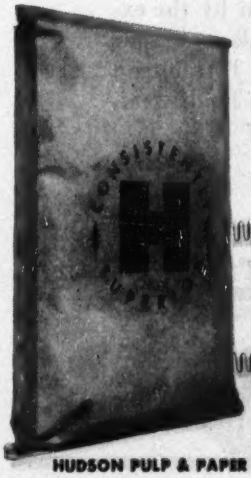
At "dry end" of Fourdrinier, water content has been reduced to proper 6%. Crane removes kraft for rewinding, slitting, and humidity-guarded storage.

Here is why HUDSON can guarantee Multiwall Sacks against breaking on your packer

REASON NUMBER 3 **HUDSON MAKES ITS OWN KRAFT**

Last year this Hudson mill made enough kraft to lay a 20-foot strip several times around the world. Hudson is a veteran of 31 years in kraft manufacture...but its Multiwall Sack mill is virtually new—with outstandingly advanced equipment.

By making its own kraft, Hudson exerts iron-clad control of Multiwall Sack quality and delivery schedules. This is another reason why Hudson guarantees to replace *without cost* all Hudson Multiwall Sacks that fail on your packing or closing machines.



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Type CHO Lectrodryer* maintains low humidity in The Nestlé Company packaging room.

"Our packaging machines don't gum up in summer any more . . ."

Summer air can contain above 500% more moisture than winter air. No wonder machines gum up! No wonder production stalls! A CHO Lectrodryer has cured these ills at the Nescafé* plant of The Nestlé Company, Inc., Sunbury, Ohio. Summer or winter, the air in packaging rooms is DRY. Production flows smoothly.

Lectrodryers are drying some production areas to as low as 10% relative humidity, regardless of weather conditions. Others are DRYing air, gases and organic liquids to dewpoints as low as −110°F.

If moisture is causing you hardship or production lags, you'll benefit by the experience of our engineers. Talk over your problem with us, or write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

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LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

*REGISTERED TRADEMARK U.S. PAT. OFF.

this is the new, improved way that Wolverine can speed your installations of CONDENSER TUBES

Ask for Shipments in "U-BEND" *pallets*

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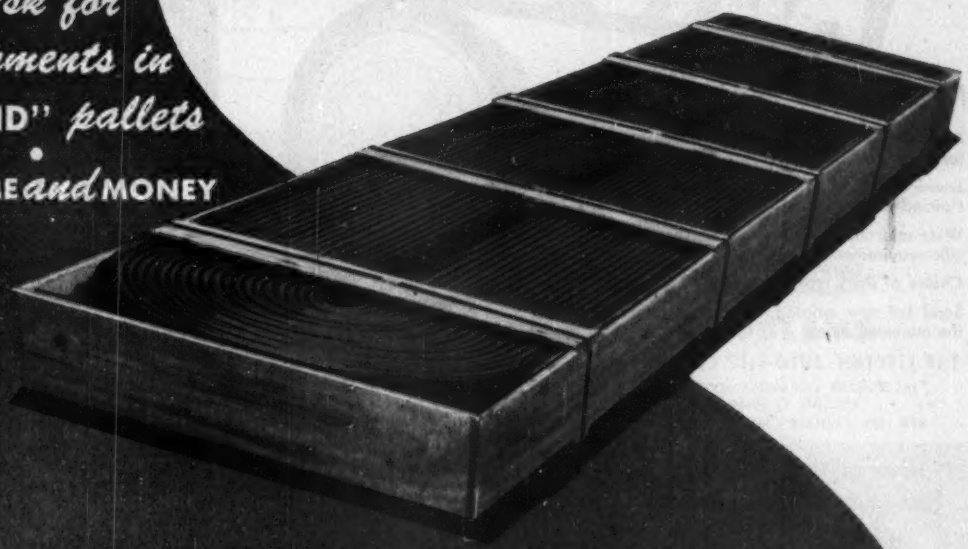
SAVE TIME *and* MONEY



Now provide yourself with a stand-by unit. Have the required replacement of condenser tubes (either plain or finned) at hand—ready for quick and efficient installation.

Arranged in a wooden pallet according to predetermined order (a whole complement of tubes, if required), the tubes can be fed as one unit directly into the condenser or heat exchanger with a great saving of time. Tube-unloading, inspection, assembly, handling and installation costs are thus materially reduced.

Each pallet is designed and constructed to suit your individual requirements. It will withstand the handling in transit. You'll receive the tubes arranged in the order you'll use them and in the perfect condition you expect them. And, too, in this condensed package form they occupy comparatively small storage space and can be easily stacked.

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For Eye-Level Readings...

AUTO-LITE

TEMPERATURE INDICATORS

- Precision-built indicators provide accurate temperature readings.
- Low-cost protection . . . due to large, specialized production.
- Wide selection of dial ranges to meet specific requirements.
- Choice of stock types available as shown.
- Send for new catalog, describing many thermometer styles.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
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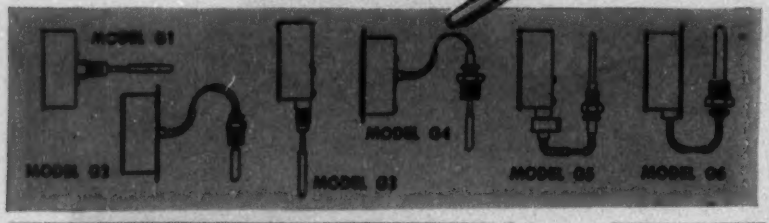
MODEL "6"
Select the type that is best for your purpose. 3½" dial; evenly calibrated scales. From $18.



Ceilcrete

a stonelike corrosion proof trowelled on surface

✓ ACID PROOF
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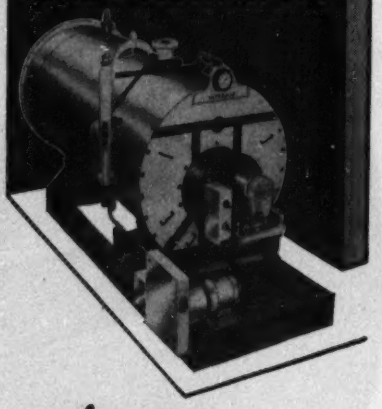
TOPPING for FLOORS • WALLS
ACID HOLDING TANKS • WASTE
DISPOSAL SYSTEMS, ETC.

THE CEILCOTE COMPANY
4832 Ridge Road, Cleveland 9, Ohio

Send for technical data on its application, corrosion resistance properties

Packaged STEAM GENERATORS



for HEAT or PROCESS

Economical, and highly efficient, **SUPERIOR Steam Generators** arrive at your plant ready to produce steam for process or heat. Completely factory assembled and tested, they are backed by undivided responsibility.

- Fully automatic burning oil or gas or both in combination.
- Mounted on rigid channel iron base, they require no special foundation.
- Built-in induced draft eliminates the need of an expensive chimney.
- Simple installation permits a nearby source of process steam.
- Battery installation provides extreme flexibility for varying steam demands.
- Special units for permanent outdoor installation.
- Fire-Tube models in 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. Write for catalog 522-F.
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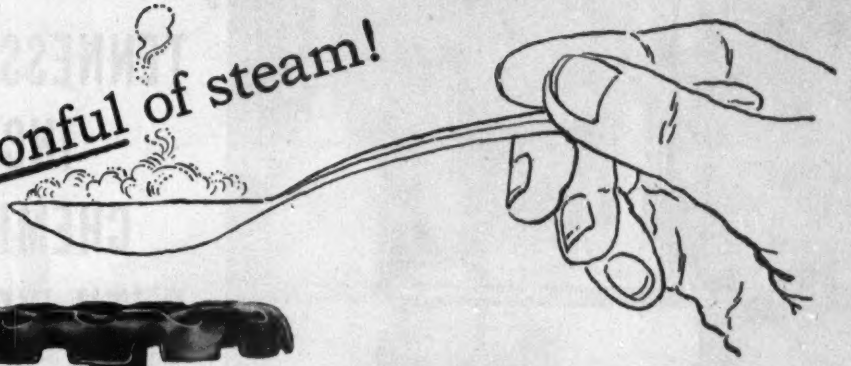
for performance you can **BANK** on

SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

a teaspoonful of steam!



HERE'S THE ANSWER TO YOUR SMALL FLOW CONTROL PROBLEMS

a NEW LESLIE REDUCING VALVE

for accurate, foolproof regulation of small flows of steam, air, gas or liquids, with inlet pressures to 1000 psi and reduced pressures from 2 to 400 psi.

Change operating conditions quickly and easily with simple, handwheel adjustment —no need to waste time changing springs or swapping parts. Check these widely accepted Leslie features that are standard in the new, efficient, Leslie Small Flow Reducing Valve.

Check these Features

- ✓ Simple, compact construction
- ✓ Top quality materials
- ✓ Metal Diaphragm
- ✓ Entirely enclosed—no stuffing boxes
- ✓ Corrosion resistant springs
- ✓ Hardened stainless steel valve
- ✓ Interchangeable inner valves

SEND FOR DESCRIPTIVE BULLETIN 511-A WITH *COMPLETE* CAPACITY TABLES

Before you order—

The new Class LCB is just one of the many units that are ***special*** with most manufacturers but are ***standard*** with Leslie.

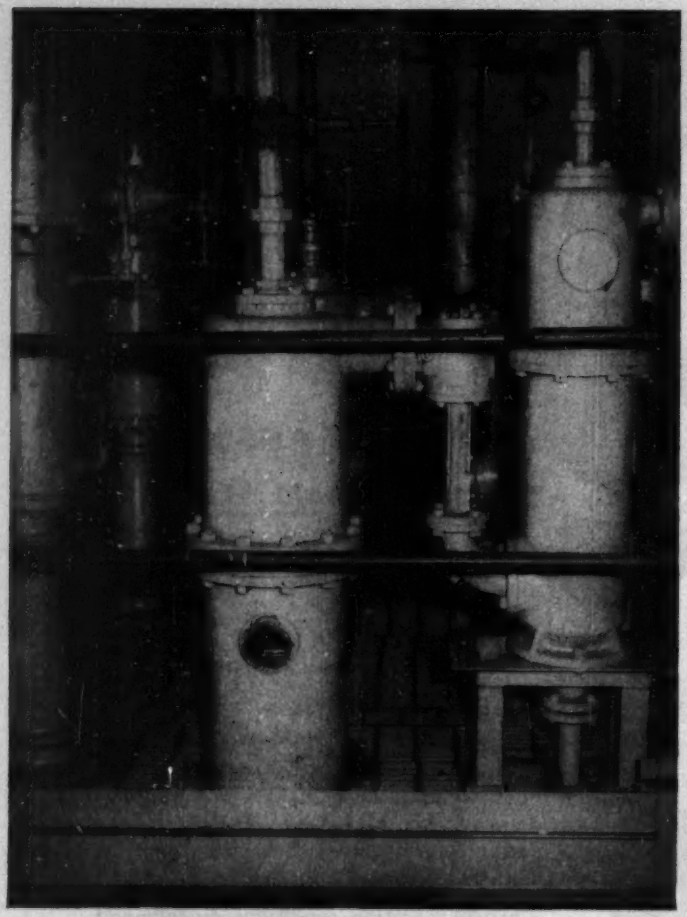
Check to see if any pressure, temperature or level control you want is standard with Leslie, before you order. Play it safe. Your Leslie Engineer is listed under "Valves" or "Regulators" in the classified telephone directory in principal cities.

LESLIE

THE FIRST NAME IN PRESSURE, TEMPERATURE AND LEVEL CONTROLS

Since 1900

LESLIE CO., 279 Grant Avenue, Lyndhurst, New Jersey



BETTER YIELDS, FEWER SHUTDOWNS have been made possible by the Worthington steam jet ejectors at Tennessee Eastman. Shown is a portion of the two Worthington 8-RPJ four-stage single element ejectors with barometric inter-condensers.

6 BIG ADVANTAGES OF STEAM JET EJECTORS FOR VACUUM SERVICE

1. *LOW INITIAL COST.*
2. *MINIMUM OPERATING COST.*
3. *NEGLIGIBLE MAINTENANCE COSTS.*
4. *NO MOVING PARTS.*
5. *EASY TO OPERATE.*
6. *AVAILABLE IN ANY MACHINABLE MATERIAL.*

TENNESSEE EASTMAN INCREASES CHEMICAL YIELD WITH WORTHINGTON STEAM JET EJECTORS

Two Worthington units replace four vacuum pumps

Tennessee Eastman Company, Eastman Kodak's division in Kingsport, Tenn., found that their vacuum pumps required periodic shutdowns and excessive maintenance. The trouble was caused by emulsions formed when the organic chemicals being processed reacted with the lubricating oil in the pumps.

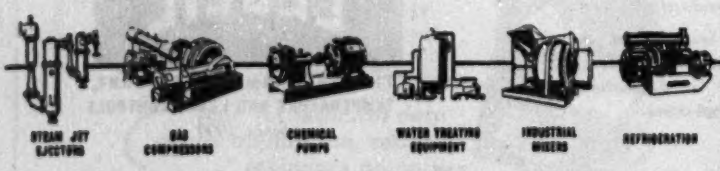
In early 1952, Tennessee Eastman replaced four of these pumps with two Worthington four-stage steam jet ejectors. Here's what Tennessee Eastman writes about the Worthington units:

"Since the ejectors use no lubricating oil, our difficulties have automatically been eliminated. The result is better yields, fewer shutdowns and less time required for both operation and maintenance."

Tennessee Eastman's experience with Worthington steam jet ejectors has been duplicated by industrial firms throughout the nation. Whether your product is corrosive or non-corrosive, there's a Worthington ejector to fit your vacuum requirements—from atmosphere to 50 microns absolute. You can get a Worthington ejector in stainless, bronze, porcelain, impervious graphite, Worthite, cast iron, or steel.

Write us about your vacuum problems. Worthington Corporation, Steam Power Division, Ejector Section X.3.1, Harrison, New Jersey.

X.3.1



WORTHINGTON
Steam Jet Ejectors

A manufacturer was faced with a costly plant shutdown not long ago because of a low inventory of alumina. One phone call to Kaiser Chemicals at 2 P.M. solved his problem—at 9 A.M. the following morning the required alumina was at his plant siding.

While this 19-hour service is not always required, it illustrates that, with Kaiser Chemicals, orders get *immediate, individual* attention, cutting delivery time, making large, costly inventories unnecessary.

This personal service—combined with unsurpassed quality and experienced technical assistance—has made Kaiser Chemicals a major supplier of calcined and hydrated aluminas. Operating one of the largest alumina plants in the country, we supply alumina to more than eighty per cent of the nation's users.

Whether you manufacture abrasives, glass, ceramics, refractories, catalysts, or chemicals for water treatment, we have the product and the service to meet your needs exactly. Contact principal sales offices: *Chemical Division,* Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California; First National Tower, Akron 8, Ohio.

Kaiser Chemicals

calcined and hydrated aluminas

Alumina • Basic Refractory Bricks and Ramming Materials • Dolomite Magnesia • Magnesite • Periclase

...the *Versenes*®

TRACE METAL TROUBLES

Infinitesimal as they may be, Trace Metals may cause all kinds of costly complications. In industrial processes and products they spoil chemicals, soaps, textiles, dyes, rubber, hides, foodstuffs, metals, plastics, paints, adhesives, drugs, pharmaceuticals, fertilizers, and dozens of other things as well. Recent intensive research on trace metal deficiency in agriculture and medicine now furnishes profound clues to the causes of sickness, health and well-being in living things. Control through chelation is the remedial action indicated.

VERSENE — POWERFUL CHELATING AGENT

As a powerful chelating agent, it is Versene's job to make trace metals tractable. It keeps them under *precise* control. Properly used, one or more of the Versenes and the chemistry of chelation can *correct* excesses or deficiencies of metallic ions. Whenever these trace metal disturbances occur they are ready to rush to your rescue.

COMPLEXING POWER GUARANTEED UNIFORM

The Versenes are extremely stable at high temperatures throughout the pH range. Made only under processes originated, developed and patented by F. C. Bersworth, uniformity of complexing power is guaranteed in either sample or carload quantities. Write Dept. 3, Ask for Technical Bulletin No. 2 and samples. Chemical Counsel available.

VERSENE WATER TEST KIT. Tells total hardness in 2 minutes. Accurate to 1 gr. per gallon. Complete with instructions. $5.00 postpaid.

Chemistry's most precise chemicals

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Braun Corporation, Los Angeles, California
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Wasatch Chemical Co., Salt Lake City, Utah
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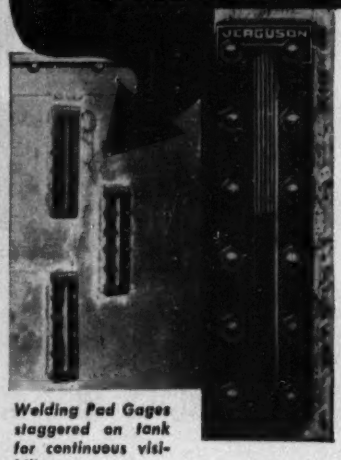
Chas. S. Tanner Co., 1015 Liberty Life Bldg., Charlotte, North Carolina
Siegel Chemical Co., Brooklyn, N. Y.

SPECIAL
JERGUSON
WELDING PAD GAGES
are integral part of this tank



Welding Pad Gages staggered on tank for continuous visibility.

HERE is a special line of gages that weld right to the liquid containing structure, thus becoming an integral part of it. It solves problems where it is impractical for you to use a conventional type gage because of solids in suspension in a liquid, etc.

These Special Gages follow Jerguson Standard Gages in general design and materials, except for the method of attaching. The chamber of the gage consists of a bar steel pad which is welded to the vessel.

Welding Pad Gages are made in both Reflex and Transparent types . . . in all sizes of Jerguson Standard Gages. Pressure ratings are available to your specific requirements. Welding pad may be of any metal desired to withstand corrosive or other conditions.

Write for Data Unit on Welding Pad Gages for complete details. Whatever your gage problems, let Jerguson engineers assist you.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

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SCRUBBING CORROSIVE GASES?

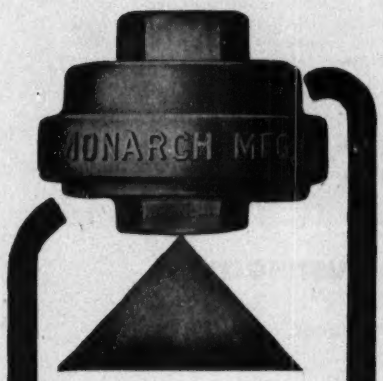


Fig. 645

Are your scrubbing nozzles as efficient as you think they could be? Do they resist the corrosion or wear conditions satisfactorily — produce the breakup and distribution you would like?

Outline your spray problem for us—if your liquid can be sprayed with direct pressure at all—Monarch can furnish the nozzles.

NOZZLES FOR:

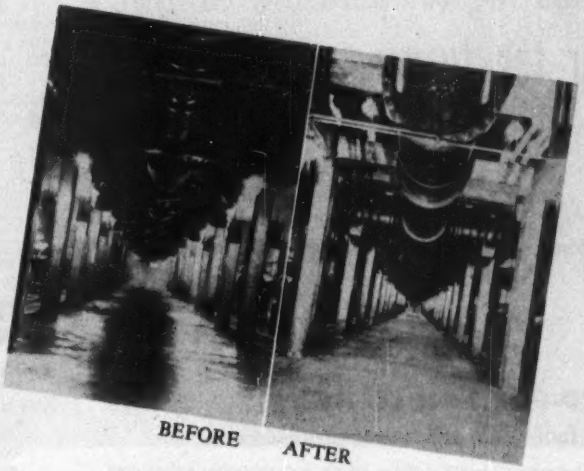
- **OIL ATOMIZING**
- **HUMIDIFYING**
- **AIR WASHING**
- **DESUPERHEATING**
- **SPRAY PONDS**
- **MILK POWDERING**
- **ACID CHAMBERS**
- **CONCRETE CURING**

Write for Catalogs 6-A and 6-C

MONARCH MFG. WKS., INC.
2517 E. ONTARIO ST.
PHILADELPHIA 34, PA.

how

pipe galleries stay dry



surrounded by cold water

The pipe galleries in Chicago's water filtration plant are surrounded by Lake Michigan water, as cold as 40° F. Before Kathabar, condensation literally created a fog in the galleries, corroded expensive equipment, rotted wiring, peeled off paint.

Moisture removal by refrigeration was impractical under the conditions prevailing. Kathabar dehumidifying units completely dried up the galleries by lowering the dew point of the air. Eliminating the condensation damage, the Kathabar units pay for themselves in less than 3 years.

Condensation is an obvious problem caused by air moisture; others may be more subtle. Kathabar know-how has eliminated humidity problems in the processing, packaging, and storage of many products such as petrochemicals, plastics, rubber and pharmaceuticals. Kathabar engineers can give you accurate control over an amazing range of air conditions; "perfect production weather" 365 days a year.

Write for literature
Group K-53-4.

Kathabar
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORP., TOLEDO 1, OHIO
ALSO MAKERS OF
Surface INDUSTRIAL FURNACES *Janitrol* AUTOMATIC SPACE HEATING

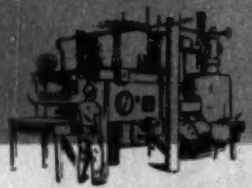
A guide for selecting temperature control for top furnace performance

Today, industry's need for lower operating costs . . . reduced maintenance . . . high quality of production . . . has spot-lighted the importance of "tight" furnace control.

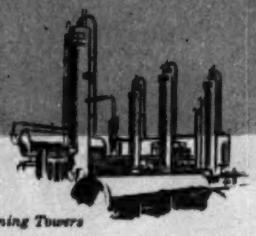
With closer specifications and higher control standards, more and more plants must pin down troublesome, costly departures from favorable heat-treating conditions.

To meet this demand, Leeds and Northrup has a complete line of matched temperature control systems available. You get equipment matched to your particular requirements. Each system comes to you as a "package" ready to handle the individual conditions created by your product, your production and your furnace.

There's an L&N control to match every industrial furnace



Chemical Processing Units



Refining Towers

TWO-POSITION CONTROL

For fuel-fired or electric furnaces

What it does:

Cuts heat input back to "low" when temperature exceeds control point . . . turns heat input on full when it falls below control point.

When to use it:

1. When changes in heat supply or changes in load are promptly "felt" by the temperature detector.

2. When alternate undershoot and overshoot will not damage product or process equipment, or slow down production.

3. When furnace pressure or fuel-air ratio *are not* controlled and the products of combustion *do not* form a protective atmosphere for the work.

PROPORTIONING-TYPE CONTROL

For fuel-fired furnaces

What it does:

Adjusts heat input by varying valve opening according to size of temperature change.

When to use it:

1. When there's a substantial time lag, before changes in heat supply or changes in load are "felt" by the temperature detector.

2. When load changes on continuous processes are both small and infrequent, and control point is rarely changed.

3. On batch process where operation is usually at the same temperature, and rapid recovery from upsets after loading is not important.

4. When furnace-pressure or fuel-air ratio *are* controlled, or the products of combustion *do* form a protective atmosphere for the work.

POSITION-ADJUSTING-TYPE CONTROL (P.A.T.)

For fuel-fired furnaces

What it does:

Adjusts heat input by varying valve opening according to size, duration and speed of temperature changes.

When to use it:

1. When there's a substantial time lag, before changes in heat supply or changes in load are "felt" by the temperature detector.

2. When load changes are both large and frequent and control point must be changed to suit various conditions.

3. When furnace design requires a continuously throttled flame.

4. When furnace-pressure or fuel-air ratio *are* controlled, or the products of combustion *do* form a protective atmosphere for the work.

5. Whenever overshoot is costly, hazardous or can cause damage to the product or heating equipment.

DURATION-ADJUSTING-TYPE CONTROL (D.A.T.)

For fuel-fired or electric furnaces

What it does:

Adjusts heat input by varying length of "heat on" time according to size, duration and speed of temperature changes.

When to use it:

1. When there's a substantial time lag, before changes in heat supply or changes in load are "felt" by the temperature detector.

2. When load changes are both large and frequent, and control point must be changed to suit various conditions.

3. When furnace design requires use of "on-off" operation of heat supply.

4. When furnace-pressure or fuel-air ratio *are not* controlled, and the products of combustion *do not* form a protective atmosphere for the work.

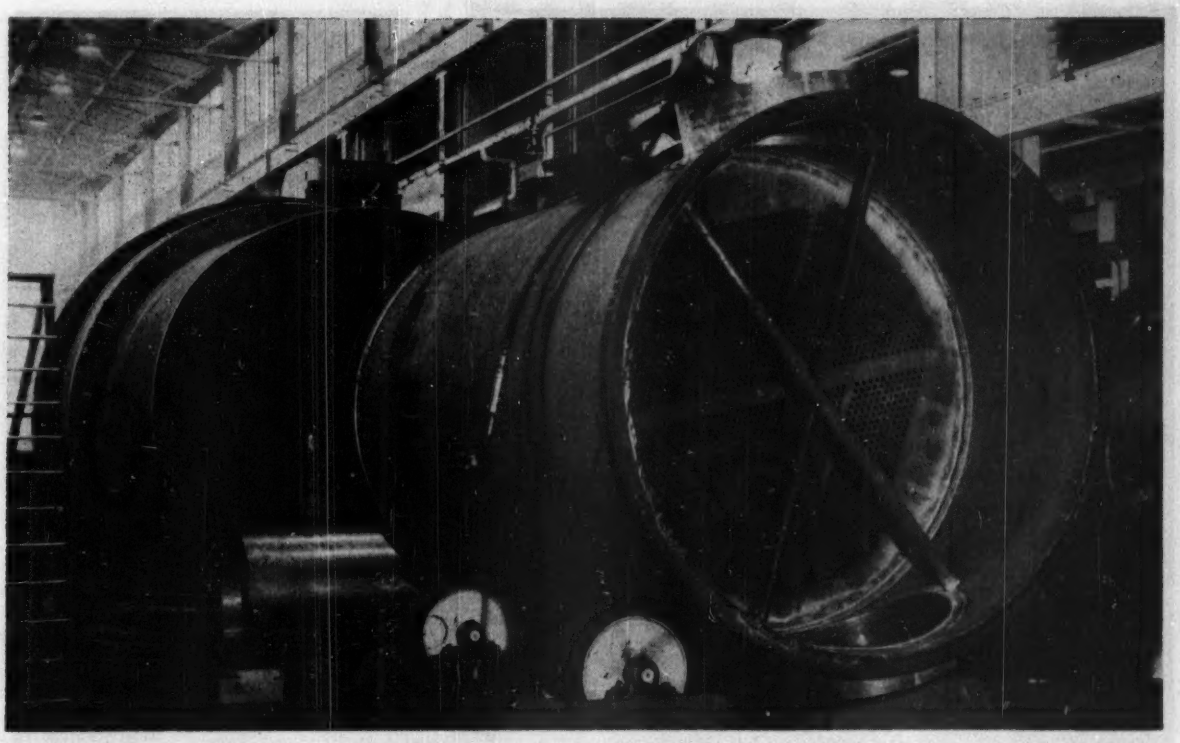
5. Whenever overshoot is costly, hazardous or can cause damage to the product or heating equipment.

***For complete information** regarding L & N Matched Temperature Control, write 4916 Stenton Ave., Phila. 44, Pa., or contact our nearest office.*

LEEDS LN NORTHRUP

instruments *automatic controls • furnaces*

Jrl Ad N33(53e)



Fabricating nickel steamchests for a Triple Effect Caustic Soda Evaporator. 2,156 Solid nickel tubes were used. The unit weighs 33,000 lbs.

BUFLOVAK'S NEW FACILITIES

BUFLOVAK has modernized and doubled its fabrication facilities. New tools and new methods build larger and better equipment.

For unusual processes equipment can be engineered and built by BUFLOVAK, or built to the customer's design. Their uses are many and varied. From lighter flints to nuclear products, or from orange concentrate to the new antibiotics, BUFLOVAK Equipment steps up production and holds down costs.

BUFLOVAK facilities include practical research and product testing, sound engineering, and modern shops. Together, these facilities produce special equipment that does exactly what you want it to do.

There is valuable information in BUFLOVAK'S new Catalog No. 362. A request on your company letterhead will bring a copy to you promptly.

FABRICATE SPECIAL EQUIPMENT FOR UNUSUAL PROCESSES

BUFLOVAK BUILDS

Evaporators
- Low Temperature
- By-Product Recovery
- Chemicals
- Food Product
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Dryers
- Vacuum Double Drum
- Vacuum Rotary
- Pilot Plant
- Atmospheric

Processing Kettles
- Mixers
- Impregnators
- Dopp Kettles
- Solvent Recovery & Distillation Equipment

RESEARCH AND TESTING LABORATORY

To assist you in the solution of processing problems, BUFLOVAK offers the facilities of its Research and Testing Laboratory—where small scale experimental units show you, before you buy, the commercial possibilities, data on production cost, and characteristics of the finished product.

BLAW-KNOX

BLAW-KNOX COMPANY
BUFLOVAK EQUIPMENT DIVISION
1549 FILLMORE AVE.
BUFFALO 11, N.Y.

Since 1900, Paterson Parchment Paper Company has used Glycerine to plasticize its Patapar Vegetable Parchment for packaging foods such as butter, margarine, shortening, pie mixes, fish, meats, poultry, celery, ice cream and frozen foods. More recently, Doughnut Corporation of America's famous biscuit and muffin mixes are Patapar-wrapped. Patapar has high wet strength and grease resistance. It must also be pliable. For over fifty years, Paterson Parchment Paper Company has used Glycerine to assure this pliability.

The plasticizing and moisture-retaining action of Glycerine adds an important "plus" to vegetable parchment, and to other widely used packaging materials. It contributes the softness and pliability essential in wrapping and bag forming.

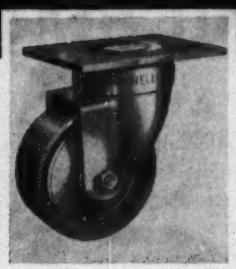
And, of course, a food packaging material must not contain any materials unsafe for use in contact with food. Here again, Glycerine is the ideal answer. It has a long-time record of acceptance, not only in food wraps, but in food products themselves. In fact, it has food value in its own right.

Applications of U. S. P. Glycerine in food processing—as a humectant, sweetener, solvent, plasticizer—have been accepted by the American Medical Association Council on Foods, and permitted by Federal and State food and drug authorities.

For a copy of "Why Glycerine for Foods?" a handy 16-page booklet on Glycerine's unique range of properties and applications, write Glycerine Producers' Association, 295 Madison Ave., New York 17, N. Y.

Nothing takes the place of Glycerine

DARNELL
CASTERS & WHEELS



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A TYPE AND SIZE FOR EVERY PURPOSE

Free DARNELL MANUAL

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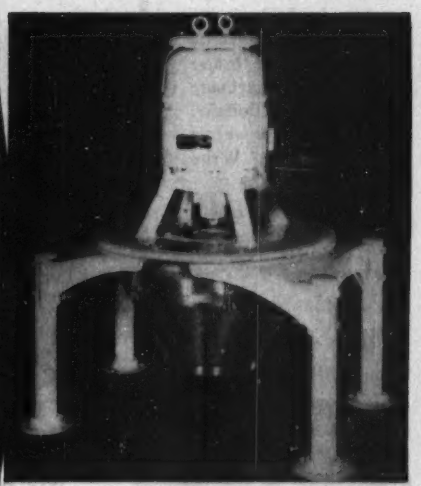
"ENTOLETER"
HIGH SPEED MIXERS

MAKE GOOD PRODUCTS *Better!*



Have You Considered an "ENTOLETER" High Speed Mixer Application for Your Product?

For further information, contact ENTOLETER DIVISION, The Safety Car Heating and Lighting Company, Inc., 1197 Dixwell Ave., New Haven 4, Conn.

ENTOLETER
CENTRIFUGAL MACHINES

The trademark "ENTOLETER" is your guarantee of satisfaction.

DON'T LET **WINTER**

ROB YOU OF PROFITS!

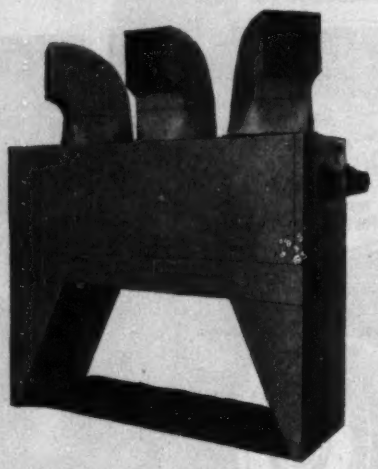
ADVANCE WEATHER FORECAST
Mercury to Drop to Zero.
COLD GRIPS CITY

NOW'S THE TIME TO INSTALL "Buffalo" UNIT HEATERS

Winter can put the "chill" on your plant and people, cutting down production, efficiency, and profits! Why take the chance? "Buffalo" Unit Heaters warm up hard-to-heat corners and areas—at low cost. Compact "Buffalo" heaters are easily and quickly installed. So right now, while it's hot, make sure it's warm in your plant next winter!—Install "Buffalo" Unit Heaters!

BREEZO-FIN

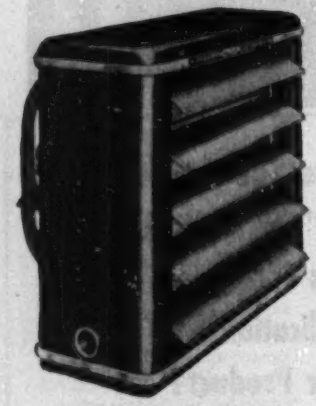
"Buffalo" Breezo-Fin Heaters deliver comfortable heat in small areas and operate economically on as little as 2 lbs. steam. Available in 20 sizes; have high-quality copper finished heater element for maximum radiation and "Buffalo" Breezo Fan to throw heat positively. Write for Bulletin 3137.



HIGHBOY

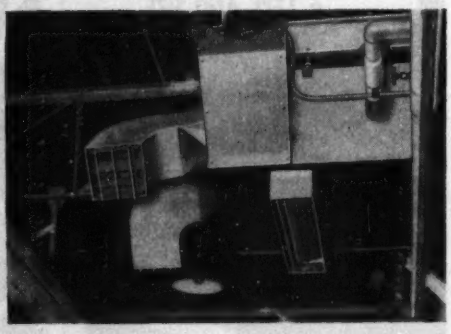
The Highboy is ideal for heating that "new addition" or any large area.

Highboy is easily adapted to your present heating system, since it has adjustable outlets for duct connections and louvers. Unit pictured has "Buffalo" non-corrosive Aerofin heater element and mixed-flow fans on hollow shaft. "Buffalo" can supply arrangements and combinations tailored exactly to your individual needs. Write today for Bulletin 3704.



NO WASTED FLOOR SPACE WITH LOW-BOY!

This suspended model supplies fresh, warm, filtered air to an entire room. In addition to its high-efficiency non-corrosive Aerofin heater element, it has "Buffalo" mixed flow fans on hollow shaft. When used as a window installation, it supplies makeup air for plants using large capacity exhaust systems.



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"Buffalo" BUFFALO FORGE COMPANY

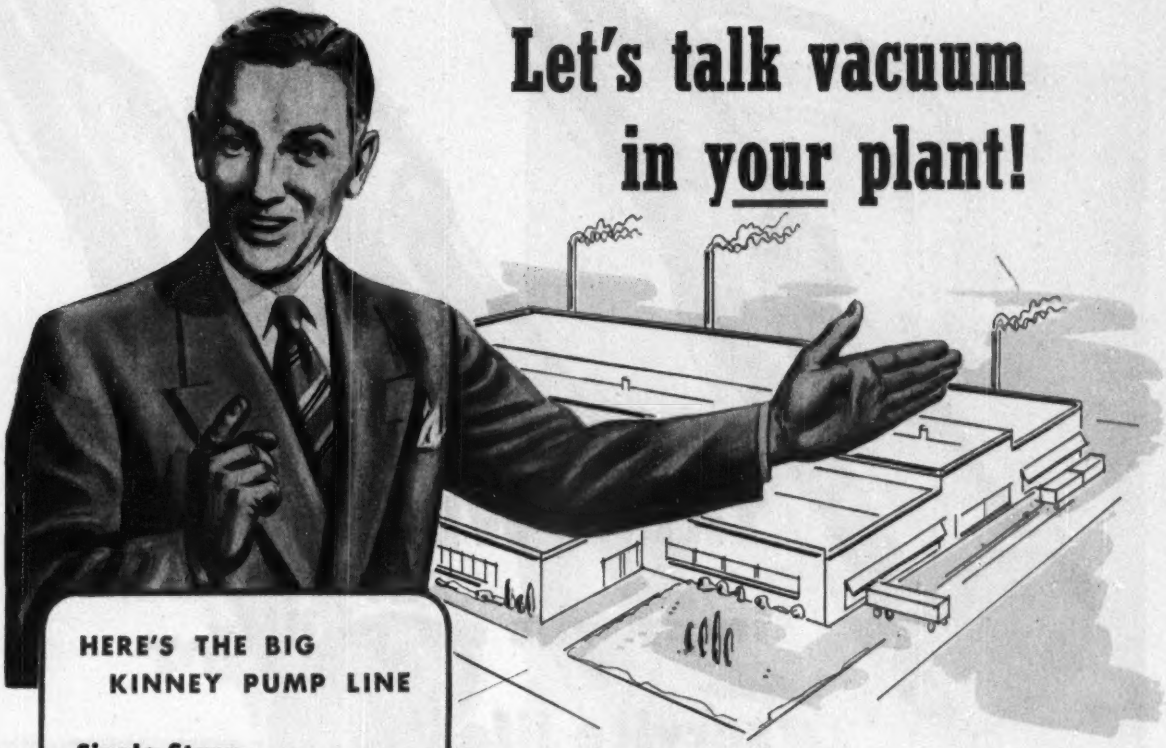
501 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Let's talk vacuum in your plant!



HERE'S THE BIG KINNEY PUMP LINE

Single Stage

Model DVH 27.20.34	1800 CFM
Model DVM 18.14.20	780 CFM
Model DVD 14.14.18	486 CFM
Model DVD 14.9.18	311 CFM
Model DVM 12.8.14	218 CFM
Model DVD 8.8.10	110 CFM
Model VSD 8.8.11	52 CFM
Model VSM 7.7.8	27 CFM
Model VSM 5.5.6	13 CFM

Compound

Model CVM 8.6.10	46 CFM
Model CVM 5.5.6	15 CFM
Model CVM 3534	5 CFM
Model CVM 3153	2 CFM

There's a qualified Kinney Vacuum Engineer in your region, ready to talk vacuum in *your* plant. Call on him. See how the BIG LINE . . . the *Kinney* line of vacuum pumps can be profitably used in exhausting lamps and tubes, freeze-drying pharmaceuticals and antibiotics, vacuum metallizing, vacuum production of titanium and other miracle metals, vacuum fumigation and impregnation — and in the countless other ways vacuum serves industry today. Kinney Manufacturing Co. — manufacturers of vacuum and liquid pumps. Boston, New York, Chicago, Detroit, Cleveland, Atlanta, Pittsburgh, Philadelphia, Los Angeles, Charleston (W. Va.), Houston, New Orleans, San Francisco, Seattle, and foreign countries.

SEND COUPON FOR DETAILS!

★ SUBSIDIARY OF THE NEW YORK AIR BRAKE CO. ★

Kinney

KINNEY MANUFACTURING COMPANY
3551 Washington Street, Boston 30, Mass.

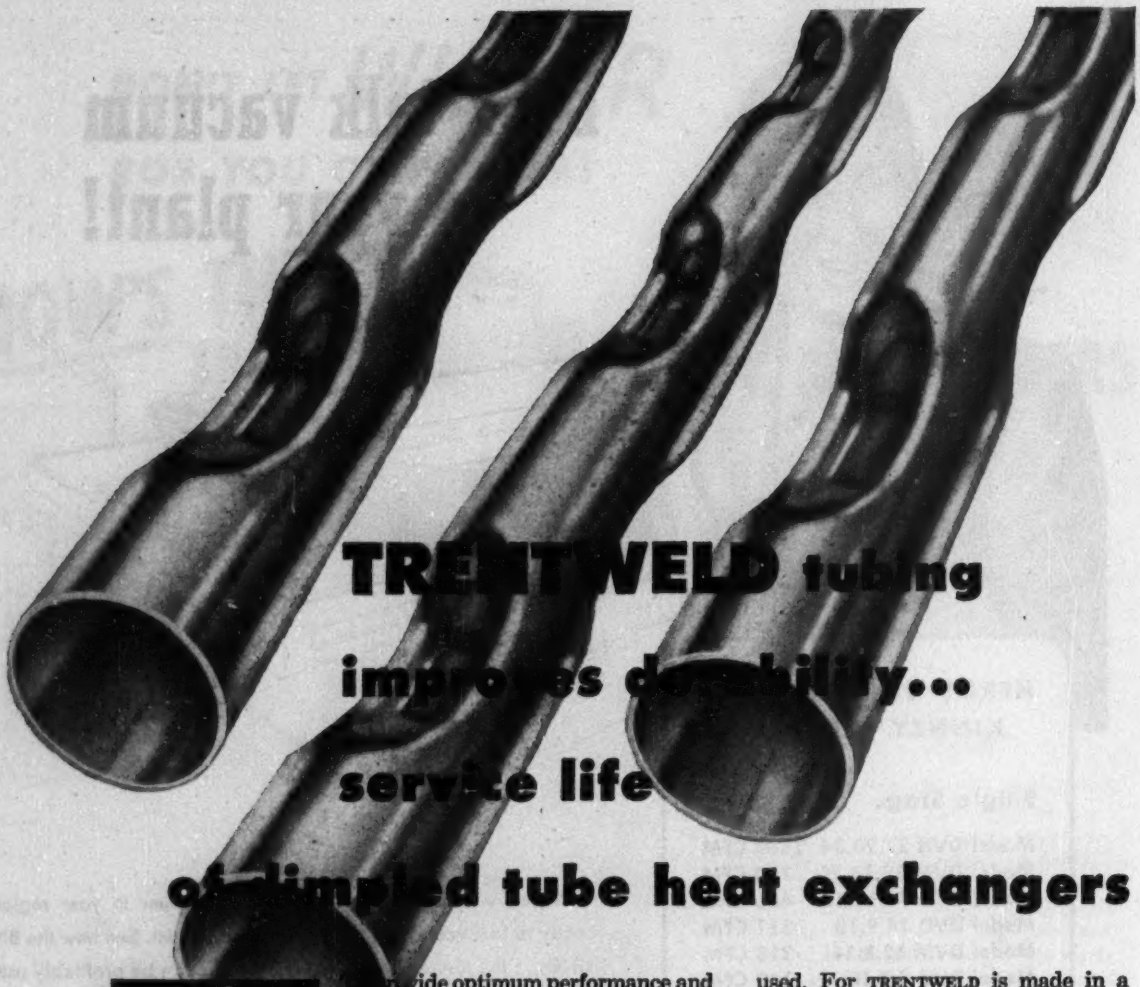
☐ Please send Bulletin V-51B describing complete line of Kinney Vacuum Pumps.

☐ Please have your Vacuum Engineer call on us.

Name.....

Company.....

City..... State.....



TRENTWELD tubing improves durability... service life of dimpled tube heat exchangers

...vide optimum performance and ...ility in extreme temperature ap...tions of their dimpled tube, air...aft heat exchangers, the AiResearch Division of the Garrett Corporation is now using TRENTWELD stainless steel tubing.

AiResearch engineers developed a technique for stepping up the cooling efficiency of their heat transfer units 26% . . . they dimple the tubes used in the construction of their heat exchangers. The dimples interrupt the smooth flow of air through the tubes and permit more rapid exchange of hot and cold molecules. But in service use these tubes are subjected to high temperatures where ordinary materials won't stand up.

That's why TRENTWELD tubing is used. For TRENTWELD is made in a tube mill by tube specialists. It is formed from accurately rolled sheet and strip and fusion welded by an exclusive process that insures complete uniformity throughout. TRENTWELD is produced in a wide range of grades, gauges and finishes and in practically any size from ⅛" up.

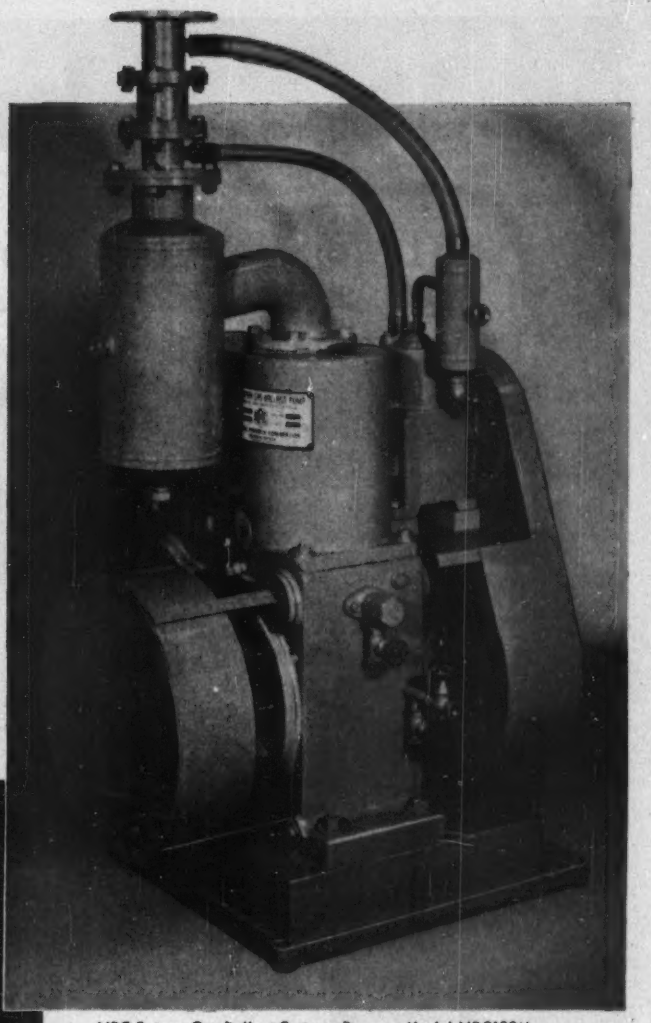
Trent Tube Company engineers have successfully solved many other application problems for stainless and high alloy tubing. Their services and broad background of experience are available to help you solve yours. If you use any form of tubing, why not call in one of our representatives. And remember, *you can't buy better tubing than* TRENTWELD.

TRENTWELD

STAINLESS STEEL TUBING

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)

Water Vapor Won't Condense in this NEW HIGH VACUUM ROTARY PUMP



NRC Rotary Gas Ballast 2-stage Pump — Model NRC100M

- Maintains initial cfm rate when pumping water vapor
- Eliminates oil reclaiming unit
- Greater capacity under 1 mm Hg
- Up to 80% less oil charge
- Capacities from 1¼ cfm to 400 cfm
- Pressures down to 10^{-4} mm Hg

The new NRC Rotary Gas Ballast Pump actually *prevents* water vapor from condensing, and contaminating the pump oil. Therefore, unlike all other type rotary vacuum pumps, fast pump down time is maintained when pumping condensable vapors. This is important news wherever vacuum is used.

NRC Rotary Gas Ballast Pumps are available in capacities from 1¼ cfm to 400 cfm; pressures down to 10^{-4} mm Hg; a full line of vane, piston-type and 2-stage pumps.

Send coupon today, for your copy of the new bulletin that gives a full explanation of the Gas Ballast principle, and complete engineering data on the construction and operation of the NRC Rotary Gas Ballast Pump.

Vane-type pump Model NRC6S

Piston-type pump Model NRC30S

NRC National Research Corporation

EQUIPMENT DIVISION, *70 Memorial Drive, Cambridge, Mass.*

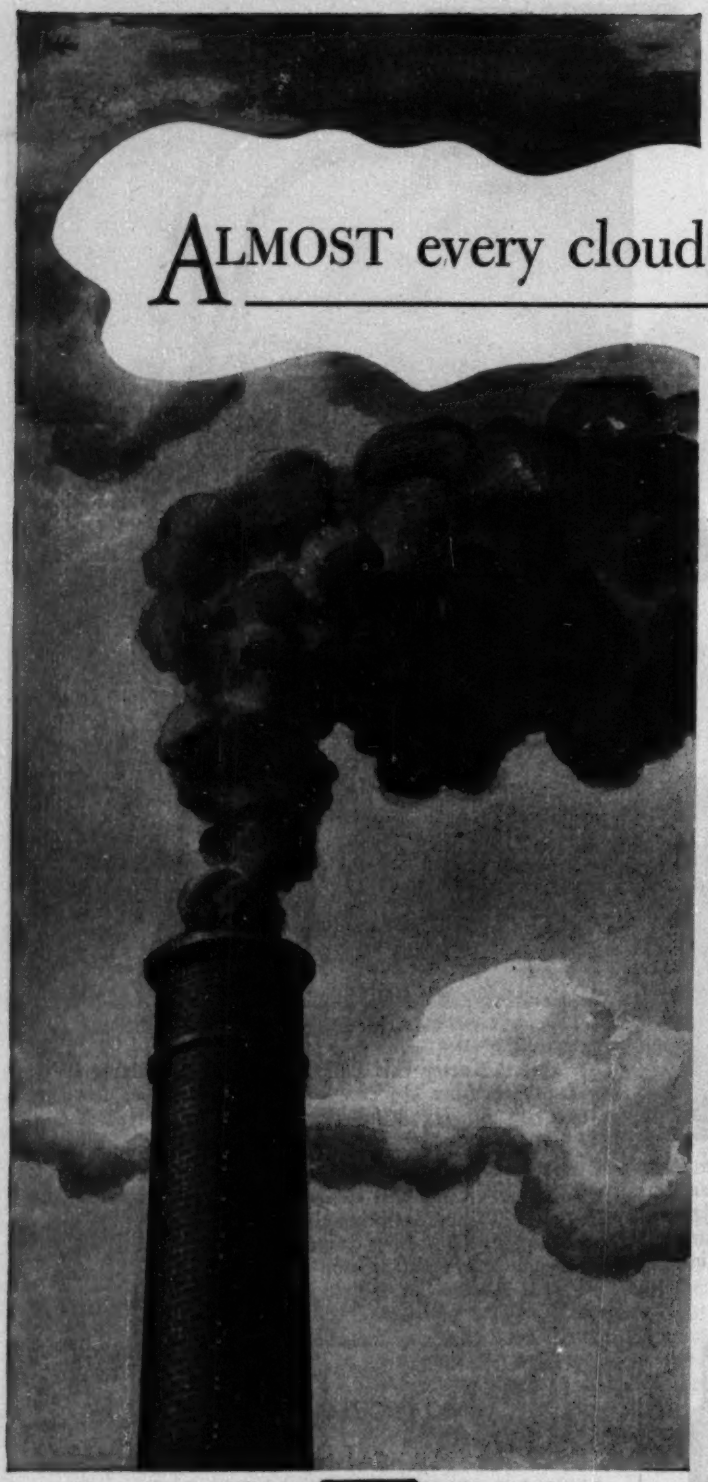
Send me more facts about the NRC Rotary Gas Ballast Pump ☐ Have your Salesman call ☐

Name _____

Title _____

Company _____

Address _____



ALMOST every cloud has a silver lining

IN CASES where Koppers-Elex Electrostatic Precipitators can be used profitably, plants have at their disposal the most effective and efficient means known for preventing actual dollars-and-cents profits from 'going up in smoke.' It does this in any one of three ways:

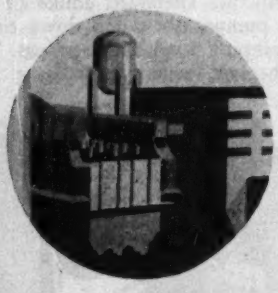
FIRST—recovery of valuable materials entrained in process gases.

SECOND—cleaning of gases for subsequent re-use.

THIRD—keeping of discharge gases well within the limits set by nuisance abatement laws—vital in maintaining good public relations in industrial communities.

Koppers precipitators can work at almost 100% efficiency . . . and operate *continuously*, too. Koppers multiple-chamber design permits the gas cleaning operation to continue uninterrupted in one chamber while another is undergoing inspection or maintenance.

Koppers - Elex precipitators are designed, engineered, fabricated, erected, and guaranteed under one contract by the Koppers Company. For analysis and recommendations relating to your operation, submit details without obligation to: KOPPERS COMPANY, INC., *Precipitator Department*, 218 Scott Street, Baltimore 3, Maryland.



GUARANTEE: All Koppers-Elex precipitators are guaranteed to meet your specifications for efficiency or residual content.

KOPPERS -*Elex* **ELECTROSTATIC PRECIPITATORS**

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC., BALTIMORE 3, MD.

Engineered Products Sold with *Service*

This Koppers Division also supplies industry with Fast's Couplings, American Hammered Industrial Piston and Sealing Rings, Aeromaster Fans, Gas Apparatus.

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U.S.I. CHEMICAL NEWS

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★

Inedible Fats, Oils, Yield New Vinyl Plasticizers

New plasticizers for vinyl plastics are now being made from inedible animal fats and vegetable oils, according to a recent announcement. The process was developed in the course of research by a Government agency to find new uses for surplus animal fats.

The process involves treatment of the acid portion of fats and oils with hydrogen peroxide in such a way that a specially oxidized oil results. The method is simple, cheap and practical, and can be used with a wide variety of materials, it is said.

A big advantage claimed for the new plasticizers is that they protect plastics containing chlorine from the discoloration and weakening caused by formation of hydrochloric acid when the plastic is exposed to heat or sunlight.

Methionine Alleviates Infant Diaper Rash

Recent clinical data released by a leading pediatrician has shown that DL-methionine can cure certain types of diaper rash. It was found that this condition could be traced to the presence of free ammonia in the urine, which is the result of a metabolic upset in nitrogen equilibrium. When DL-methionine was added to the infants' formulas, it was found to restore the proper nitrogen balance and make the rash disappear within 7 to 10 days. This use of methionine should lead to practical applications by practitioners confronted with stubborn cases of diaper rash or napkin dermatitis.

Booklet Covers Selection, Use of Paint Strippers

A new, 13-page booklet of instructions on paint stripping has been published describing procedures for stripping "practically any finish" from all metals and woods. The booklet gives valuable hints on paint stripping generally, and includes a reference chart to simplify selection of the right stripper for the job. The stripping of paints from vertical and overhead surfaces of all kinds are covered.

Soil Conditioners Rated

Results of tests conducted by an independent agricultural research service to rate the effectiveness of 16 commercial soil conditioners are now available, it has been announced. The conditioners were tested for their performance in stabilizing soil aggregation in plots of silty, clay loam. Soil samples were examined before and after application over a period from July to December of last year. The report identifies the most effective synthetic conditioners as shown by these tests.

U.S.D.A. Scientists See Their Research Translated Into First Full-Scale Allethrin Plant

U.S.I. Honors Scientists Credited with First Successful Synthesis of Allethrin; Public Inspection of Plant Held for Representatives of Government and Industry

Three of the scientists who first successfully synthesized allethrin in the laboratory were recent guests of U.S.I. to see how their research has been translated into the nation's first full-scale plant for commercial production of this important insecticidal chemical.

The scientists are Drs. Milton S. Schechter, Frederick B. LaForge, and Nathan Green, chemists of the U. S. Department of Agriculture who announced in March 1949 that they had synthesized a "pyrethrin-like" chemical in their laboratory. As early as May 1949, U.S.I. had adapted this complex synthesis—which involves 18 separate processes—to production of substantial quantities in the laboratory. U.S.I. technologists evaluated the chemical, now designated as allethrin, in exhaustive tests and became convinced that it had a valuable place in insecticide formulations, although it was not the "synthetic pyrethrum" that some had thought when it first appeared.

Production Now at Full Rated Capacity

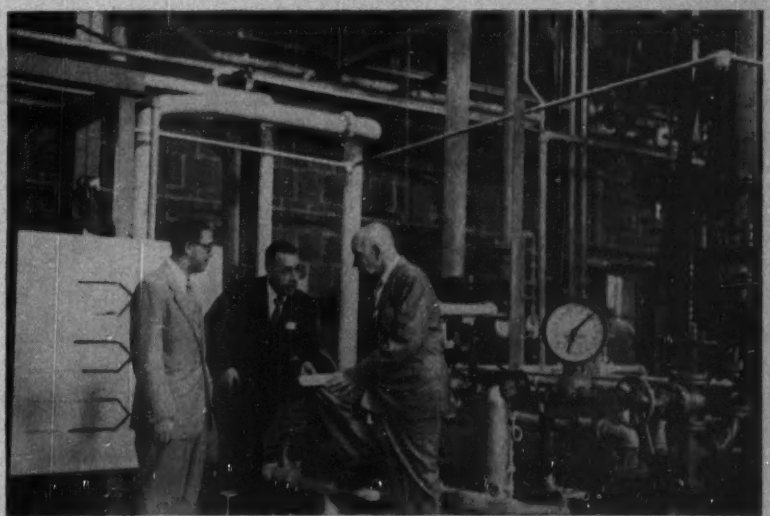
The next step in allethrin's progress was a long program of further chemical and entomological research, and finally the engineering and construction of a fully integrated plant devoted exclusively to the production of allethrin. Since its opening last October, production of this new plant has increased each month to its full rated capacity. The men whose long research touched off this important addition to industrial chemistry were

MORE

Use Radioactive Dirt In Dishwashing Tests

Dirt and bacteria, made radioactive with phosphorus-32, are being used in current research to test the efficiency of cleansers in making eating utensils clean and safe. The research is part of a non-commercial organization's program to develop a scientifically accurate yardstick for measuring dirt and bacterial removal from eating surfaces.

Studies so far have shown that different surfaces vary widely in their retention, with glass, china and stainless steel being the easiest surfaces to clean. In one series of tests, washing removed from 97 to 99 per cent of the bacteria from hard surfaces. It was found by use of a Geiger counter and exposure to x-ray film that identical washings removed as little as 56 per cent from less hard surfaces.



William P. Marsh, Jr., (center), President of U.S.I., is shown discussing details of the complex allethrin manufacturing process with Dr. Milton S. Schechter (left) and Dr. F. B. LaForge (right), two of the three U. S. Department of Agriculture scientists who were the first to separate and identify the four active principles of pyrethrum and to synthesize one of them, allethrin, in the laboratory.

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U.S.I. CHEMICAL NEWS

CONTINUED

Allethrin Plant

guests of honor June 3rd at U.S.I.'s formal public introduction of the plant in Baltimore.

Valuable Adjunct to Pyrethrins

Allethrin is a close but not exact duplication of one of the constituents of pyrethrum—the oldest and one of the safest insecticides known. Its action on many species of insects, however, is quite different from that of the natural product, depending upon such factors as method of application, synergist used and others. It is an effective insecticide in itself, low in toxic hazards, and it serves as a valuable adjunct to pyrethrins. In this way, it will help to spread the limited supplies of the natural product, particularly in insecticides having low toxic hazards to humans and animals.

Allethrin is a valuable insecticidal agent. It is finding its greatest immediate usefulness in household aerosols and sprays designed primarily for the control of flies. In the case of aerosols, U.S.I. research has shown that combinations of allethrin and of allethrin and pyrethrins with piperonyl butoxide are both effective and competitive with present formulas. Various combinations have been thoroughly tested, and U.S.I. has available for industry approved formulas and complete formulations, as well as the chemicals themselves, individually and in combination. Combinations of pyrethrins and piperonyl butoxide are well-known in the industry under the U.S.I. trade name Pyrenone.

New Data on Proteins And Amino Acids in Feeds

A newly revised edition of the booklet entitled "Proteins and Amino Acids in Animal Nutrition" has been made available to feed manufacturers and feed formulators by U.S.I. This article, written by a prominent nutritionist, presents the most recent data available on amino acid supplementation of vegetable proteins in feeds. Copies of this new revised edition may be obtained by writing on your company letterhead to the Editor, *U.S.I. Chemical News*.

Find Ferric Chloride Checks Artery Hardening

The simple iron salt, ferric chloride, may prove to be the means for preventing or controlling hardening of the arteries, according to recently disclosed research. Lengthy tests on chickens, the best animals for studying this disease, have shown that ferric chloride blocks the fat-absorbing machinery of the body. By doing this, it keeps cholesterol—the offending component of fatty foods—from passing into the blood stream where it can form harmful deposits.

Experimental tests showed that cholesterol is absorbed from the intestinal tract with the aid of active salts in the bile. Ferric chloride, it was found, effectively inactivates this property of the bile salts, thus suppressing the passage of cholesterol into the blood stream. Even when test birds were put on high fat and cholesterol diets, the iron salt was able to keep fat and cholesterol in the blood at nearly normal levels. Microscopic studies of the arteries after four to six months showed that the birds had also been protected against arteriosclerosis, or artery hardening, according to the report.

New Freight Car Handles Dry Chemicals in Bulk

A new type of freight car, which is said to make practical and highly economical for the first time the bulk shipment and handling of a wide range of dry powdered materials, was put on display recently. Products for which the car is suitable include feed stuffs, chemicals, starches, and similar commodities previously considered impractical for bulk handling, according to the announcement.

Described as a radically new type of covered hopper car, the equipment is claimed to make available to shippers substantial savings in containers, dunnage and labor. In addition to these savings, the car also provides improved sanitation and less danger of contamination of the product, it is said.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U. S. I.

A new waterproof, heat resistant adhesive is described as a thermosetting, self-curing cement which is neutral when cured and resistant to salt and fresh water, fungus, many acids, solvents, and lubricating oils. **(No. 940)**

A new non-drip tinless can for both thin and viscous materials features a turned in lip on a nozzle which cuts off the flow of liquid after pouring. The plastic cap closure is also a measuring device. **(No. 941)**

A fluorine-containing anesthetic, trifluoroethyl vinyl ether, is claimed to be faster acting and to reduce tremendously the fire and explosion hazards associated with use of conventional ether. **(No. 942)**

To control algae, scale, and bacteria in spray ponds, cooling towers, other water applications, compounds are available which will not precipitate in alkaline water, contain a wetting agent for quick penetration, and will remove calcium carbonate scale, it is said. **(No. 943)**

A new cleaner and wash for aluminum, stainless steel, and chrome surfaces is claimed to be easy to use and to leave an invisible coating which protects against further discoloration. **(No. 944)**

For drilling holes in glass, concrete, tile, plaster, brick, stone, etc., a new type drill for hand and power tools is also claimed to be ideal for drilling new holes in hardened dies, fixtures, tools, and broken studs. **(No. 945)**

A new non-ionic surface active agent, especially tailored for emulsion paints is said to be both a powerful emulsifying and wetting-out agent, and to be effective in low concentrations. **(No. 946)**

To prevent rusting of steel, cast iron, etc., during storage, a new concentrate used in water solution reportedly leaves an almost invisible film which can protect the steel against rusting in 100% humidity for several weeks or more. **(No. 947)**

A combination flask and separatory funnel has a flat bottom for heating, can be manipulated to draw off either the heavier or lighter liquid, permits a variety of chemical operations to be carried out without changing containers, the manufacturer states. **(No. 948)**

To seal out dampness and moisture in masonry, a new cement-based powder containing silicones and metallic compounds is claimed to form an irreversible, insoluble compound which fills and expands in the pores and repels water. **(No. 949)**

PRODUCTS OF U.S.I.

ALCOHOLS
Amyl Alcohol (Isoamyl Alcohol)
Butanol (Normal-Butyl Alcohol)
Fusel Oil—Refined
Propanol (Normal-Propyl Alcohol)

Ethanol (Ethyl Alcohol)
Specially Denatured—all regular and anhydrous formulas
Completely Denatured—all regular and anhydrous formulas
Pure—190 proof U.S.P., Absolute—200 Proof
Solox*—proprietary solvent—regular and anhydrous

ANTI-FREEZE
Super Pyro* Anti-Freeze
U.S.I. Permanent Anti-Freeze

ETHERS
Ethyl Ether, U.S.P.
Ethyl Ether, Absolute—A.C.S.

ACETONE—A.C.S.

ANSOLS
Ansol* M
Ansol* PR

ACETIC ESTERS
Amyl Acetate—Commercial and High Test
Butyl Acetate
Ethyl Acetate—all grades
Normal-Propyl Acetate

OXALIC ESTERS
Dibutyl Oxalate
Diethyl Oxalate

PHTHALIC ESTERS
Diamyl Phthalate
Dibutyl Phthalate
Diethyl Phthalate

OTHER ESTERS
Diatol*
Diethyl Carbonate
Ethyl Chloroformate

RESINS (Synthetic and Natural)
Arochem*—modified types
Arodure*—urea-formaldehyde resins
Arofene*—pure phenolics
Arofluf*—for special flat finishes
Arofint*—room temperature curing phenolic
Aroplaz*—alkyds and allied materials
Aropol*—copolymer modified alkyds
Ester Gums—all types
Natural Resins—all standard grades

INSECTICIDE MATERIALS
Allethrin
CPR Concentrates: Liquid & Dust
Piperonyl Butoxide
Piperonyl Cyclonene
Pyrenone* Concentrates: Liquid & Dust
Pyrethrum Products: Liquid and Dust
Rotenone Products: Liquid and Dust

INSECTIFUGE MATERIALS
Indalone*
Triple-Mix Repellents

INTERMEDIATES
Acetoacetanilide
Acetoacet-ortho-chloroanilide
Acetoacet-ortho-toluidide
Acetoacet-para-chloroanilide
Ethyl Acetoacetate
Ethyl Benzoylacetate
Ethyl Sodium Oxalacetate

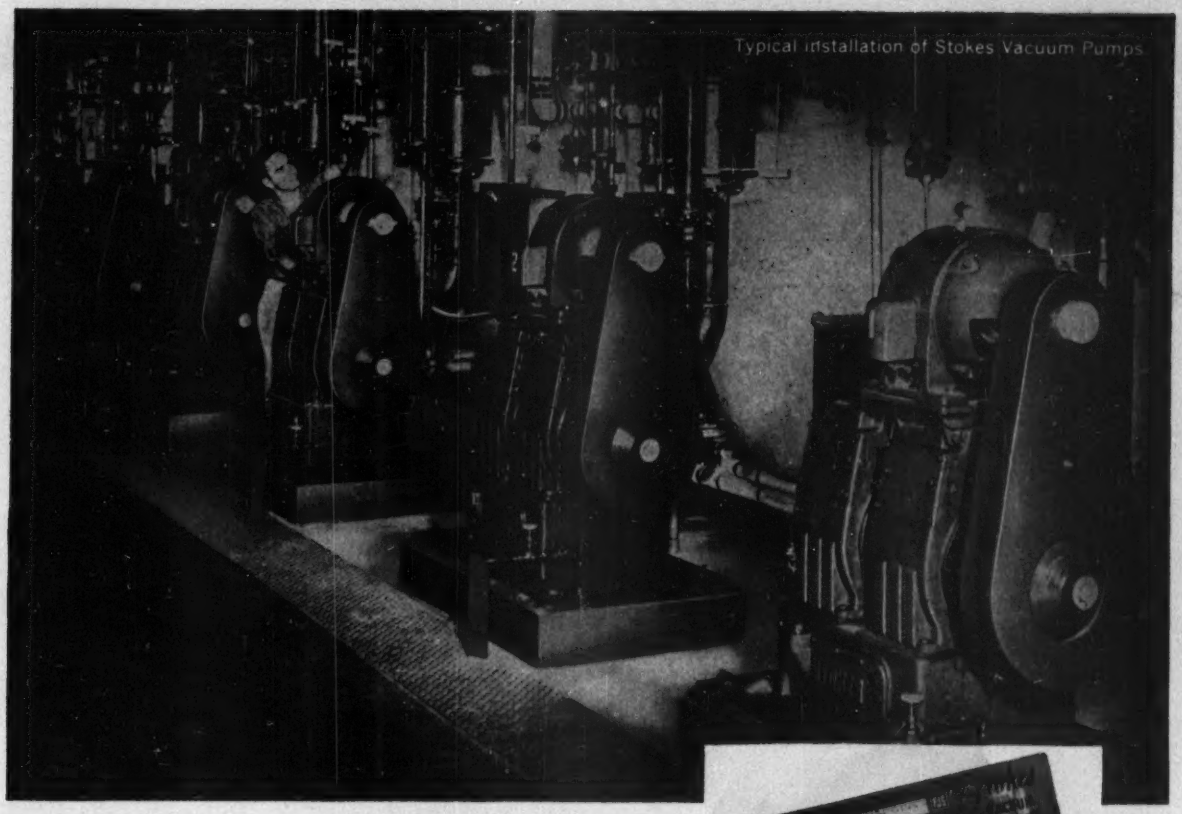
FEED PRODUCTS
Calcium Pantothenate (Feed Grade)
Choline Chloride
Curbay 8-G*
DL-Methionine (Feed Grade)
Niacin, U.S.P.
Riboflavin Concentrates
Special Liquid Curbay*
U.S.I. Vitamin B_{12} and Antibiotic Feed Supplements
Vecatone* 40

OTHER PRODUCTS
Acetaldehyde
Caustic Soda
Ethylene
IPC (Isopropyl-N-Phenyl Carbamate)
CIPC
Liquid Chlorine
Metallic Sodium
Methionine (Pharm.)
N-Acetyl DL-Methionine
Nitrocellulose Solns.
Propionaldehyde
Propionic Acid
Sulfuric Acid
Urethan, U.S.P.

*Reg. U.S. Pat. Off.

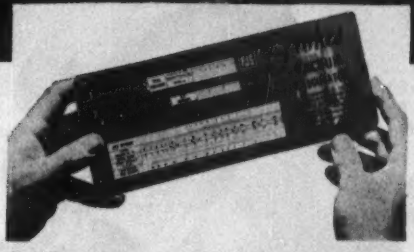
U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation

120 BROADWAY, NEW YORK 5, N. Y. BRANCHES IN ALL PRINCIPAL CITIES



Typical installation of Stokes Vacuum Pumps

Stokes Microvac Pumps... basic to Vacuum Processing



Send for new Vacuum Calculator for rapid slide-rule calculations. Includes standard ABCD log scale. Also send for Catalog 700, "Stokes Microvac Pumps for High Vacuum," with copious reference material.

High volumetric and mechanical efficiency make these famous pumps economical and reliable units in any vacuum system.

Capacities of Stokes Microvac Pumps run from 15 to 500 cfm . . . pressures to 10 microns absolute. Power consumption is low and the top-mounted motor contributes to compact design requiring minimum floor space.

Lubrication of the four moving parts (including the exhaust valve of corrosion-resistant Teflon) is fully automatic. There are no stuffing-boxes or grease-fittings, and no packing.

Parts are precision-finished, standard and interchangeable. Freedom from wear assures years of trouble-proof service.

Stokes is the only manufacturer of equipment for complete vacuum systems, including Microvac mechanical pumps, oil diffusion pumps, McLeod Gages and Vacuum Valves.

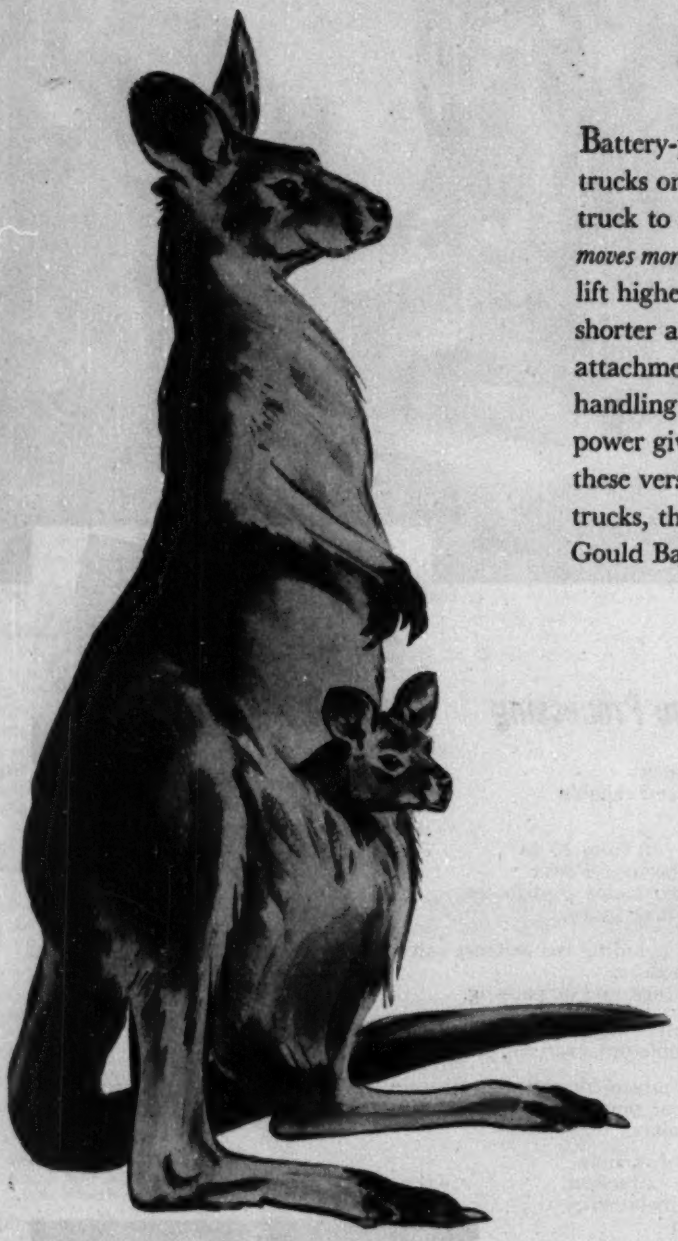
Consult with Stokes on the application of vacuum to drying, freeze-drying, impregnating, extraction, solvent recovery, evaporating, vacuum metallizing, and to other purposes for which vacuum deserves exploration.

F. J. Stokes Machine Company,
Philadelphia, Pa.

STOKES

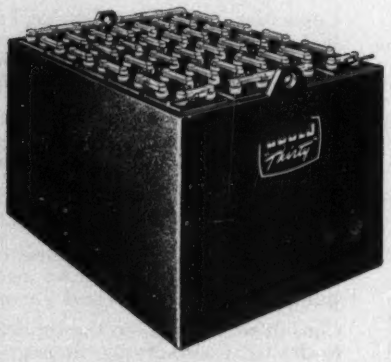
STOKES MAKES Plastics Molding Presses / Industrial Tabletting and Powder Metal Presses / Pharmaceutical Equipment / Vacuum Equipment / High Vacuum Pumps and Gages / Special Machinery

EXTRA LOAD-CARRYING CAPACITY
THANKS TO BATTERY POWER!



Battery-power keeps modern industrial trucks on the move . . . enables each truck to make *extra* trips per shift . . . *moves more tons at lower cost.* Today's trucks lift higher, maneuver faster, turn shorter and accept a wider range of attachments to meet today's materials handling requirements. Gould battery power gives you extra capacity for these versatile units. For industrial trucks, there's *no* power like Gould Battery power.

Specify
THE GOULD "THIRTY"—
America's Finest
Industrial Truck Battery



GOULD INDUSTRIAL BATTERIES

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

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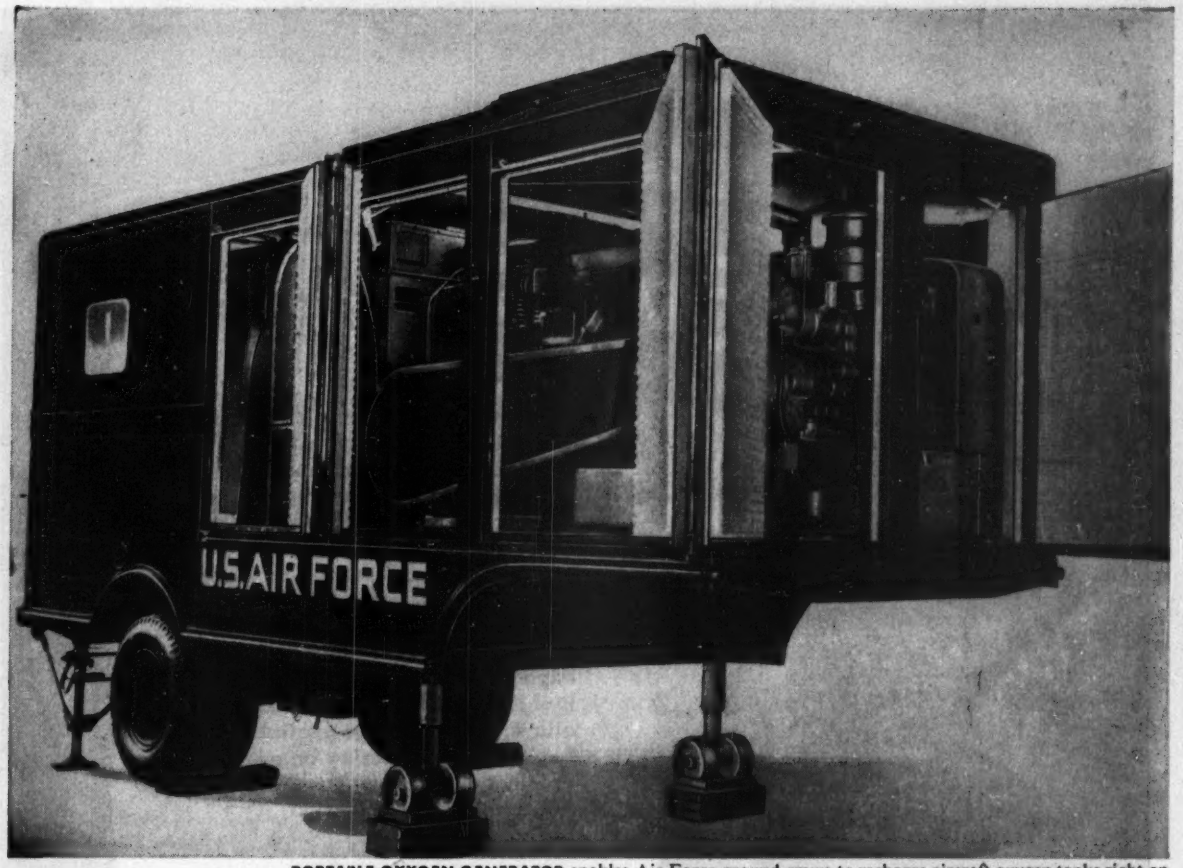


PORTABLE OXYGEN GENERATOR enables Air Force ground crews to recharge aircraft oxygen tanks right on the field. Previously, it was necessary to ship oxygen from central plants, sometimes for great distances.

Portable oxygen supply for the Armed Forces

Worthington two-stage Freon compressor used in mobile oxygen generator

A new portable oxygen generator, produced by Air Products, Inc., of Allentown, Pennsylvania, supplies our armed forces with oxygen in the field. A dependable supply of oxygen is an absolute necessity to our fliers, medical corpsmen, and engineers. Both the U. S. Air Force and the U. S. Army have accepted this mobile unit as standard equipment.

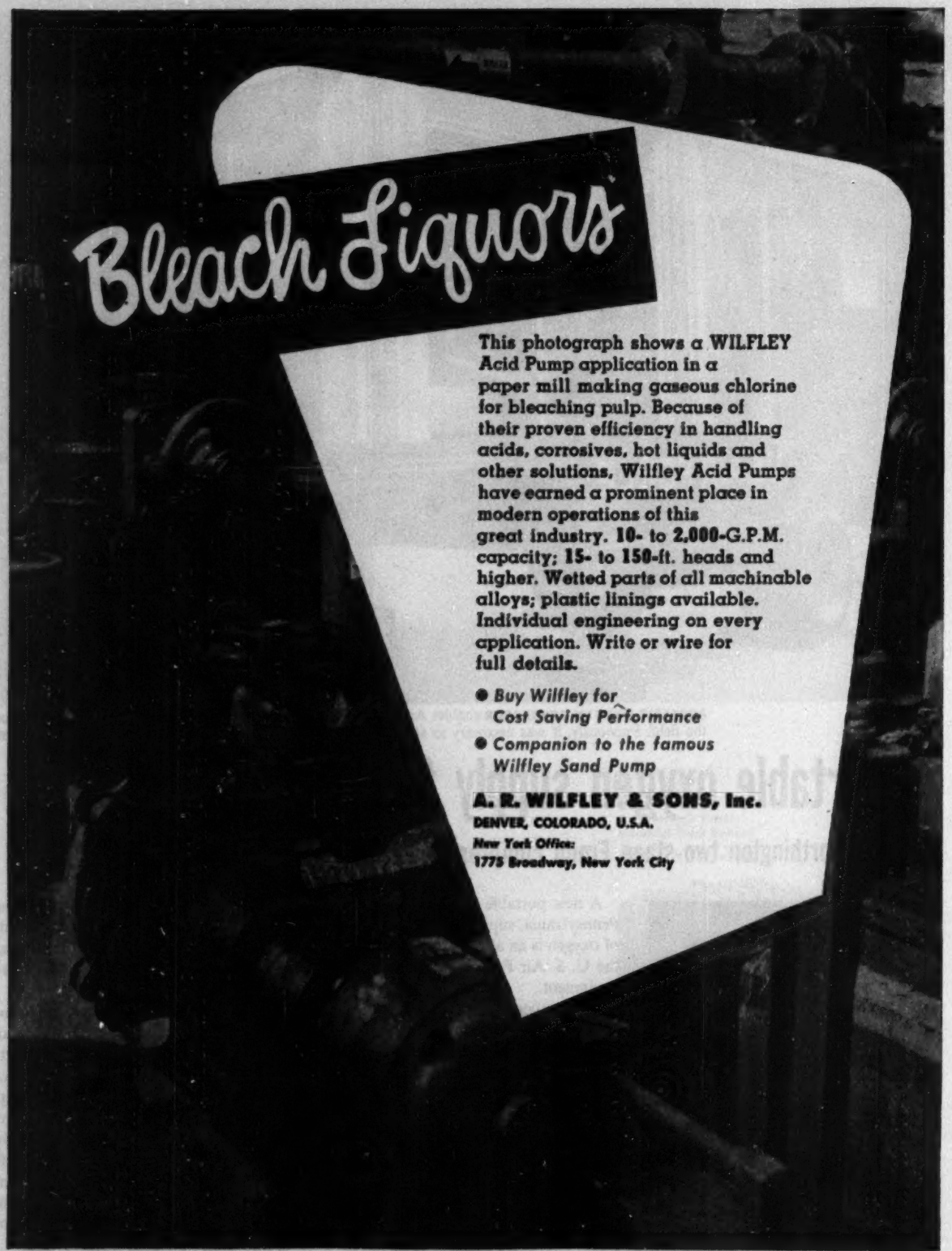
A major component of the oxygen generator is a Worthington two-stage, 15-hp Freon refrigeration compressor. This compact unit makes it possible to cool atmospheric air to minus 65 degrees F. After compression, the air is liquefied and then separated into oxygen and nitrogen. The nitrogen is used when needed as a fire blanket in fuel tanks.

Since the turn of the century, Worthington air conditioning and refrigeration equipment has been serving the armed forces, business, and industry—meeting any assignment, large or small. Worthington systems are all Worthington-*made*, not just Worthington-assembled. In addition to getting a perfectly balanced system, users benefit by Worthington's complete unit responsibility. So when you think of air conditioning or refrigeration—think of Worthington. Get in touch with your nearest Worthington district office, or write Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.39, Harrison, New Jersey.

A-3.39

Climate Engineers to Industry, Business and the Home

WORTHINGTON



This photograph shows a WILFLEY Acid Pump application in a paper mill making gaseous chlorine for bleaching pulp. Because of their proven efficiency in handling acids, corrosives, hot liquids and other solutions, Wilfley Acid Pumps have earned a prominent place in modern operations of this great industry. 10- to 2,000-G.P.M. capacity; 15- to 150-ft. heads and higher. Wetted parts of all machinable alloys; plastic linings available. Individual engineering on every application. Write or wire for full details.

- *Buy Wilfley for Cost Saving Performance*
- *Companion to the famous Wilfley Sand Pump*

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WILFLEY *Acid* PUMPS

Hooker Chemical Guide
(ONE OF A SERIES)
USE this handy reference to save time in selecting high quality chemicals.

HOOKER CAUSTIC SODA

50% LIQUID	FLAKE
73% LIQUID	SOLID

Used in these products and processes:

wood pulp
soap
glass
chemical intermediates
phenol
resorcinol
naphthol
oxalic acid
indigo
sodium salts
pigments
aniline dyes
ceramics
pharmaceuticals
cosmetics
viscose rayon
cleaning compounds
reclaiming rubber
mercerizing cotton
reclaiming tin
food processing
reclaiming paper
metal ore refining
bleaching textiles
petroleum refining
dyeing textiles
engraving
printing textiles
lithography
water softening
and many, many others

DEPENDABLE DELIVERIES

When you order chemicals from Hooker, you know that you are dealing with a reputable, dependable supplier. You can count on prompt deliveries, timed to fit your production schedule.

GROWING...TO SERVE YOU BETTER

New Chicago Office—To better serve Midwestern chemical users, Hooker has recently opened an office at 1 North LaSalle Street in the heart of Chicago's Loop. Midwestern users need only call Chicago, CEntral 6-1311, to receive fast shipment from the main plant at Niagara Falls. Hooker technical personnel will also be stationed at the Chicago office to assist you with your chemical requirements.

New plant at Montague, Michigan—In addition to the existing plants at Niagara Falls and Tacoma, Hooker is building a plant at Montague, Michigan which will increase chlorine and caustic soda production by 100,000 tons per year. Construction will be completed in 1953. This plant will further speed deliveries to Midwestern users.

Research and development—Over 100 regular products, and many more research products, have been made available through Hooker's specialized experience in chlorination, hydrogenation, esterification, sulfhydration, hydrochlorination, and fluorination. Complete laboratory and pilot plant facilities are ready to serve you.

Products available now—Chlorine, muriatic acid, sodium sulfide, chlorobenzenes, and many other products are available for immediate shipment. For full information, write on your letterhead to *Hooker Electrochemical Company*, 5 Forty-Seventh Street, Niagara Falls, N. Y.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY
NIAGARA FALLS • TACOMA • NEW YORK • CHICAGO • LOS ANGELES

HOOKER CHEMICALS

Understanding Corrosion:

THE EFFECT OF HUMIDITY

Relative humidity — the degree to which air is saturated with moisture — influences corrosion in one direction where metal is exposed to atmosphere and in another where it is immersed in a solution surface-exposed to the same atmosphere.

It is humidity, in combination with temperature, that determines whether moisture can exist on a metal surface. Because moisture is essential to atmospheric corrosion, humidity, at normal temperatures, becomes the factor that determines whether corrosion will occur and to what extent. Its effect, negligible below 30%, increases until a critical point is reached at about 65%. When air so moisture-laden carries even minute quantities of such gases as sulphur dioxide, corrosive action is greatly intensified. It is this condition that renders difficult the protection of steel stacks, breechings and economizers in service below the dew point.

For metal immersed in a corrosive solution, the reverse is true. More rather than less humidity in the air above is the preferable situation because of the way in which humidity influences the rate of oxygen solution. The rapid evaporation that occurs in dry atmosphere leaves a cool, dense surface layer of liquid that carries dissolved oxygen through the solution as fresh, unsaturated liquid replaces it for a repetition of the process. As the pace at which oxygen is brought in contact with the metal is thus stepped up, corrosion increases proportionately.

Protection of metal exposed to atmosphere or immersed in corrosive solutions, particularly under difficult or unusual service conditions, has long been the function of Dampney equipment-engineered coatings. Our experience in the handling of corrosion problems peculiar to industrial power and processing operations is not only extensive but specific . . . applicable, we feel sure, to your individual needs. Let us tell you more about Dampney coatings and what they offer . . . in terms of *your* requirements.

MAINTENANCE FOR METAL

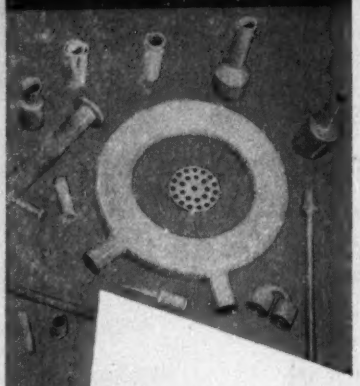
THE DAMPNEY COMPANY

HYDE PARK, BOSTON 36, MASSACHUSETTS

155-1

McDANEL

HIGH TEMPERATURE PORCELAIN SPECIALTIES...



McDanel engineers are trained and experienced ceramists who stand ready at all times to develop custom dies, balanced bodies, mixes and new processes if necessary to produce porcelain products that will exactly suit your needs.

Protection Tubes
Insulation Tubes
Combustion Tubes
Zirco Tubes
Insulators
Crucibles
Specialties

VITEROUS ALUMINA AND PURE ALUMINA

MILL LINING
SPECIAL SHAPES
TANK LINING

WRITE FOR "INDUSTRIAL PORCELAIN" CATALOG

McDANEL

REFRACTORY PORCELAIN CO.

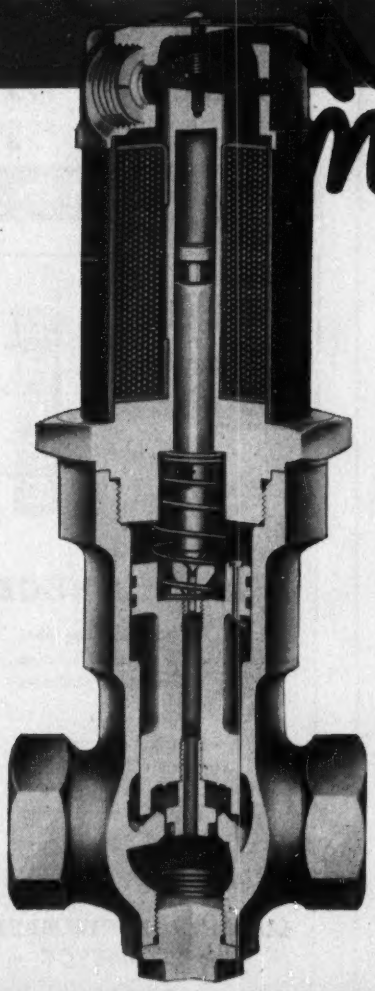
BEAVER FALLS, PENNA.

For Remote or Automatic Control . . .

FOR RUGGED DEPENDABILITY ON LOW OR HIGH PRESSURE LINES

Look to . . .

Atkomatic SOLENOID ELECTRIC VALVES



Whether your requirements are ¼ inch or 3 inch valves, or your pressures are as high as 3,000 psi., there's an Atkomatic Solenoid Valve to fit every industrial need where the media is not harmful to bronze.

An exclusive feature of the Atkomatic valve is adjustable timing on the closing stroke available on valves for pressures up to 300 psi. Shock on supply lines is eliminated or reduced through the use of this feature. Closing strokes can be delayed up to thirty seconds for complete closing.

Atkomatic Solenoid Electric Valves are designed for ease of maintenance and servicing. Designed with only three moving parts and no external linkage, valve wear is greatly reduced. Packless, full-ported, tight closing, sturdy, dependable . . . you'll find that Atkomatic Solenoid Electric Valves are the valves to fit your requirements.

WRITE FOR MORE COMPLETE INFORMATION

LOOK TO . . . **Atkomatic** SOLENOID **ELECTRIC VALVES**

ATKOMATIC VALVE COMPANY • 545 ABBOTT STREET • INDIANAPOLIS 25, INDIANA

Pangborn

UNUSUAL OPPORTUNITIES FOR

DUST CONTROL ENGINEERS

IN RAPIDLY EXPANDING FIELD WITH ESTABLISHED TOP RATED ORGANIZATION

● *DESIGN and DEVELOPMENT ENGINEER*

Design and Development Engineer experienced in dust handling systems, design of industrial dust and fume control and collecting equipment. Position requires initiative, technical ability and experience to develop, design and test practical, marketable equipment; from his ideas and those of others. Must have successful record designing industrial equipment.

● *APPLICATION ENGINEER*

To survey and study industrial plant conditions, prepare recommendations for dust and fume control including system design, layout and calculation, equipment selection, cost estimates. To establish application engineering practices on control systems and equipment. Investigate new application fields. Duties involve some field work.

● *EXPERIMENTAL and TEST ENGINEER*

For laboratory and field experimental and test work on industrial dusts and fumes and control equipment. Experience in air flow testing, dust sampling and counting, particle size analysis and industrial hygiene preferable. Some field test work. Prefer graduate engineer with laboratory or industrial experience in similar work.

Excellent working conditions; paid vacation and holidays; group life insurance; sickness and accident benefits; employee's profit sharing plan; family hospitalization and surgical plan. Good schools and ideal suburban living.

Replies confidential. State education, experience, age, expected starting salary.

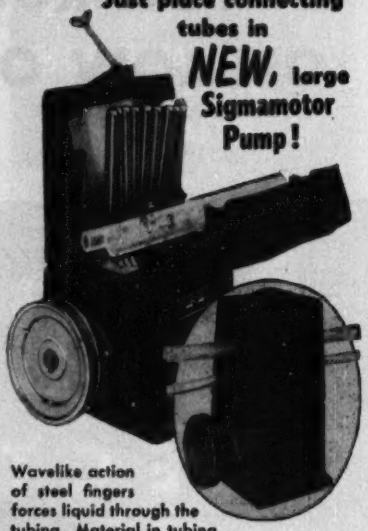
Please address Mr. W. O. Vedder, Mgr., Dust Control Dept.

Pangborn CORPORATION

HAGERSTOWN, MARYLAND

Pump liquids, gases, solids in solution

Just place connecting tubes in NEW, large Sigmamotor Pump!



Wavelike action of steel fingers forces liquid through the tubing. Material in tubing never touches pump. Stops contamination and corrosion. Excellent for handling of corrosive solutions. **$195.00**

Smaller unit with capacities to 30 gallons per hour..... **$55.00**

SIGMAMOTOR Inc.

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CHECK

	YES
LABOR	☑
WATER	☑
TRANSPORTATION	☑
POWER	☑

and DOUBLE-CHECK

. . . and it would be hard to find a plant location better suited for profitable production.

The industrial advantages of Lumberton's "Accessible Isolation" are outlined in a FACT FOLDER that is yours for the asking.

Address:

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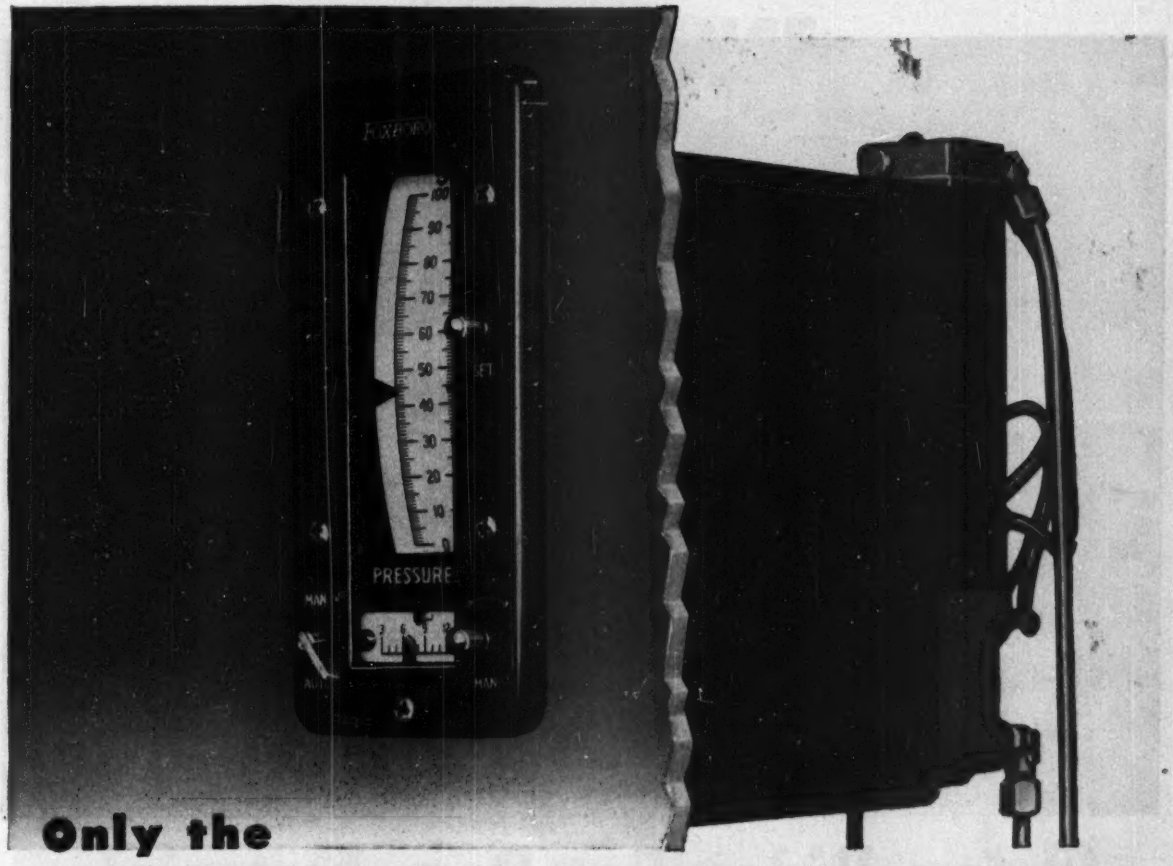

Only the CONSOTROL M/52 gives you all these advantages!

For indicating control functions in your console or graphic panel instrumentation, no other controller offers so much for so little money as the Foxboro Consotrol M/52 Indicating Controller. Compare these combined advantages:

1. **A completely self-contained, compact, panel-mounted Indicating Receiver Controller** that costs up to 20% less, installed, than usual graphic panel indicating control.
2. **Simple installation** — only 2 connections besides the air supply.
3. **Pull-out feature** that provides complete accessibility of control mechanism from front of panel.
4. **Instrument-type pressure transmitter for driftless** remote manual control, instead of usual pressure regulator.
5. **Simple 2-position transfer switch** and "foolproof" transfer indicator provide absolutely bumpless transfer.
6. **Graphic panel compactness** — takes only 3⅛" x 7¾" of panel space.
7. **"Full-size" performance** — control action unsurpassed by the finest conventional-size controllers. Available in Proportional, Proportional with Reset, Proportional with Derivative, Proportional with Reset and Derivative, and On-Off.
8. May be used with separately-mounted recorder using conventional circular charts. Up to 6 records may be combined on one chart with the Foxboro Multi-Record Recorder. (Consotrol Recorder-Controllers, featuring full scale 4" strip charts, also available.)

Get full details of this space-saving, cost-saving instrumentation. Write for Bulletin 362 describing the complete Consotrol Line of graphic panel instruments. **The Foxboro Company, 368 Neponset Ave., Foxboro, Mass., U. S. A.**

FOXBORO
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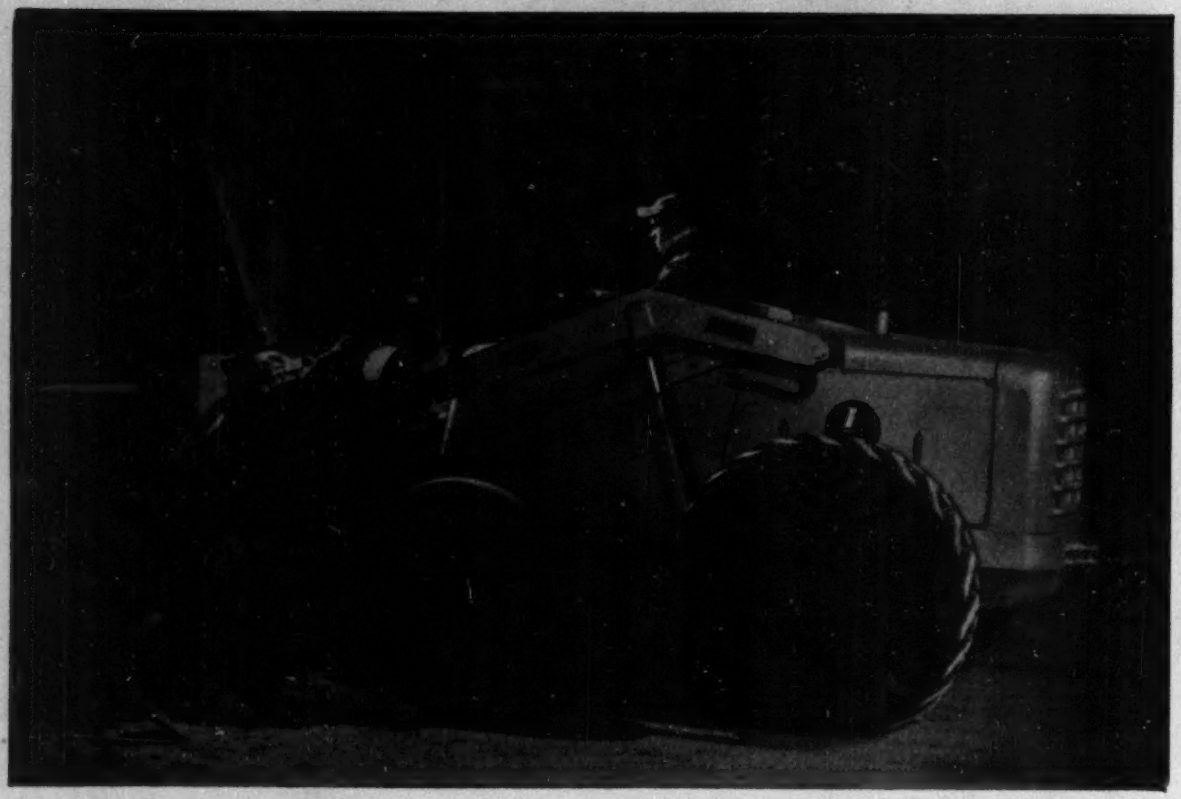
RECORDING · CONTROLLING INDICATING
INSTRUMENTS



Cheap Rides For Raw Materials

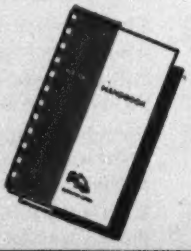
In thousands of plants, day after day, "PAYLOADERS" are moving fertilizer, chemicals and *all* kinds of bulk materials with great savings in time and costs. Indoors and outdoors these agile tractor-shovels scoop-up, carry, unload, load, transport, stockpile, windrow and spread. They maneuver in close quarters and can travel rapidly in both directions. That's because they have ample power, short wheelbases, big pneumatic tires and multiple speeds in reverse as well as forward. "PAYLOADER" application is simple and flexible too — they can go right to work without a lot of expensive plant alteration.

It will pay *you* to find out how "PAYLOADERS" pay BIG on bulk-handling operations of all kinds.

There are eight models, ranging from the 12 cu. ft. size that will unload box cars, up to the big 90 HP 1½ cu. yd. Model HM . . . also a choice of front-wheel drive, rear-wheel drive or four-wheel drive to best fit your needs. Your "PAYLOADER" Distributor, one of 200 in the U.S. and Canada, is ready to serve you *right* with complete parts and service departments. The Frank G. Hough Co., 754 Sunnyside Ave., Libertyville, Ill.

FREE HANDBOOK

Tells how and where to look for signs of inefficient bulk materials handling . . . how to analyze, organize and set up an efficient handling system . . . plus many useful tables and data. Write for "Bulk Materials Handbook."



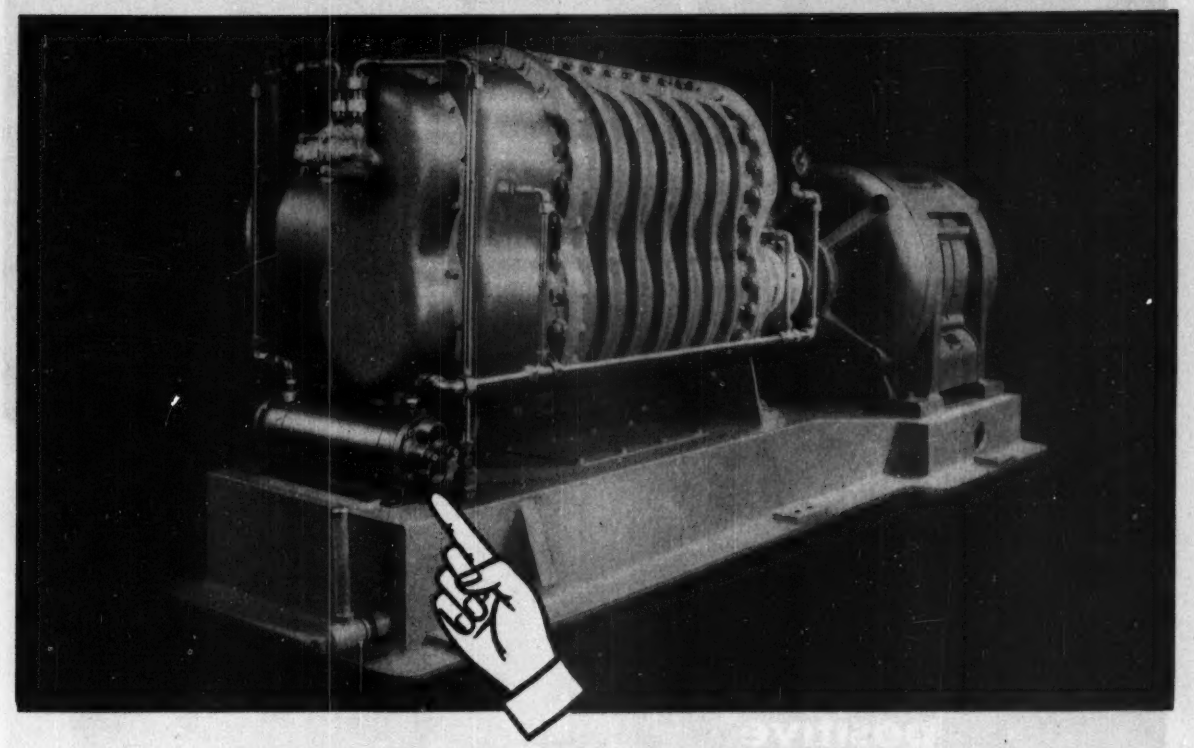
PAYLOADER®

SAY "HUFF"

SEE PAYLOADERS at the Materials Handling Exposition — Booth 1349

PAST EXPERIENCE

determines the lube oil cooler choice for this new R-C SPIRAXIAL COMPRESSOR



ROSS EXCHANGERS

New in design and new in principle, within its range, this new Roots-Connersville Spiraxial Compressor has been introduced to bridge the gap between conventional Rotary Positive and Centrifugal Compressors.

To provide this new unit with safe, dependable lube oil cooling, Roots-Connersville Blower, a Division of Dresser Industries, Inc., furnishes a Ross Type BCF Exchanger. The "reasons why" are quite natural. Roots-Connersville rotary gas boosters and multi-stage centrifugal blowers have been Ross Exchanger equipped for years. *What better basis for selecting a component than first hand experience?*

. . . And just as past performance makes Ross Exchangers the logical choice as lube oil coolers here, so too have they become the logical choice of other leading manufacturers to safeguard temperatures in engines, speed increasers, turbines, pumps, torque converters and the like.

Equally important to machinery and equipment builder is the ready availability of enduring copper and copper alloy Ross Type BCF Exchangers in a wide range of fully standardized designs pre-engineered to meet most requirements.

For more information, write for Bulletin 1.1K5.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
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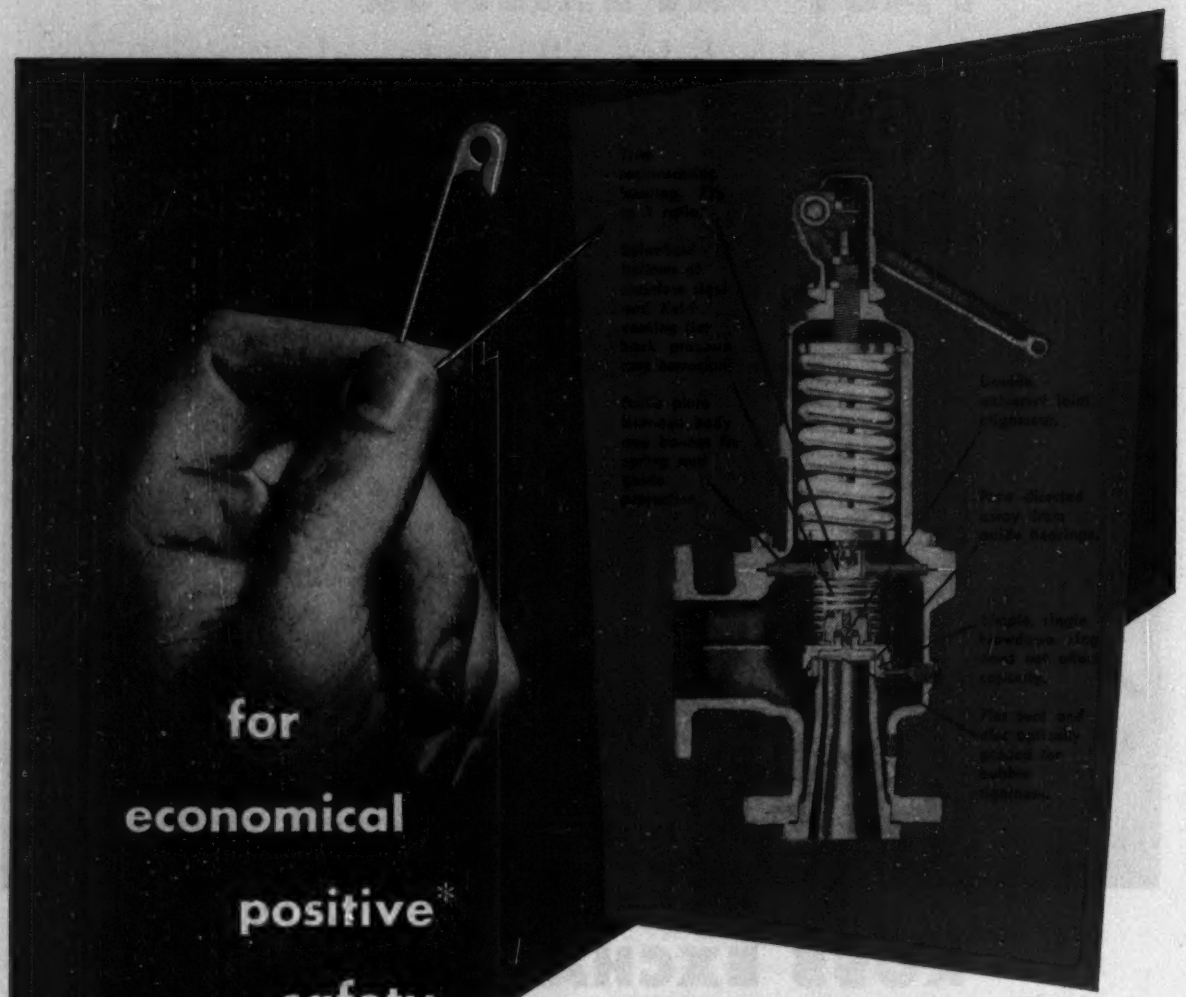
Serving home and industry:

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS



BalanSeal and FarriSeal Safety-Relief Valves

(Pat'd & Pat. Pending)

Farris

ENGINEERING CORPORATION

501 Commercial Avenue

PALISADES PARK, NEW JERSEY

Corrosion and varying back pressure—the two dangerous enemies of positive safety-relief valve operation—are stopped cold by the ingenious construction of Farris valves. Critical working parts are isolated from the lading fluid so that they can't stick, plug or corrode and the special bellows construction nullifies the effect of back-pressure surge. You get positive protection, under all operating conditions. Manufacturing economies offer realistic pricing—and the design permits the use of much smaller discharge piping, at an important saving. So for safety and economy, specify FarriSeal or BalanSeal safety-relief valves. You're never stuck, because they never stick!

Technical manual, 51B, a treatment on Back Pressure Piping and Surge characteristics and 76-page catalog is yours for the asking.

*ASME-N.B. APPROVED
(Certified for Capacity)

Affiliates:

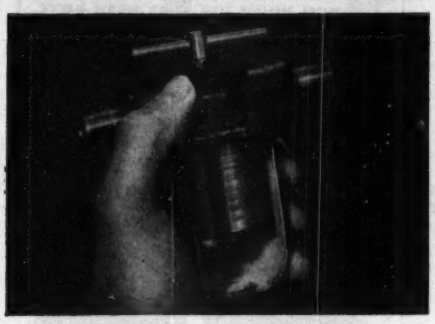
• FARRIS FLEXIBLE VALVE CORPORATION • FARRIS STÄCON CORPORATION • FARRIS HYDROTORQUE CORPORATION
• FARRIS HYDROSEAL CORPORATION • FARRIS PICKERING CORPORATION

Here's how this strainer "combs" itself clean!

This simple chalk test shows how AUTO-KLEAN's unique built-in comb construction cleans the strainer without costly interruption of flow

ORDINARY BLACKBOARD CHALK leaves heavy deposit of chalk particles on and between discs of Cuno AUTO-KLEAN strainer.

TURNING HANDLE ONE REVOLUTION moves strainer element through comb blades, removing all traces of chalk from between discs. Cuno's exclusive combing operation cleans *thoroughly* —without stopping flow.



FILTERING AREA IS COMPLETELY CLEAN, restoring full initial capacity. All chalk particles and dirt fall to bottom of housing where they can be drained periodically.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass, or stainless steel for long, trouble-free service.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 15,000 gallons per minute.

CUNO ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

AUTO-KLEAN'S "NON-STOP" FLUID FILTRATION STEPS UP PRODUCTION IN CHEMICAL PLANTS

There's no need to shut down to clean this strainer!

The Cuno AUTO-KLEAN is the only fluid cleaner on the market that operates continuously—without requiring costly interruptions in flow and service. Cuno's exclusive "comb-clean" action allows *complete* cleaning of the filter element without stopping fluid flow.

Thus, no loss of production, no chance of contaminating the product by exposure while cleaning or replacing an element.

AUTO-KLEAN's low pressure drop permits *full-flow* operation on gravity, low pressure, or suction lines—with no loss in operating efficiency. AUTO-KLEAN's compact construction provides this full-flow fluid protection in space which would limit ordinary filters to by-pass service.

The low maintenance costs of the AUTO-KLEAN save you money, for there are no cartridges to change. An occasional rotation of the handle does a thorough cleaning job (most units can be equipped with motor-drives for continuous cleaning).

Fixed-space metal discs in this modern strainer positively remove all solids larger than the specified disc spacing—from .0035" up to .062".

Find out now about Cuno's AUTO-KLEAN—the precision-built strainer.

A.3.2

Cuno Engineering Corporation
Dept. South Vine Street, Meriden, Conn.

Please send information on Cuno AUTO-KLEAN for .....
(fluid)

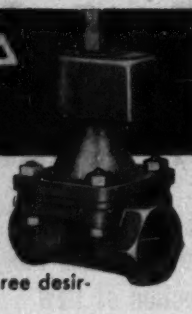
Name.....

Company.....

Address.....

City.....Zone....State.....

This is the SPECIAL ASCO Bulletin 8336 Valve



Combining . . . Automatic Remote Pilot Control with the . . . Saunder's Type Diaphragm Valve

With this valve, you can bring into your flow control three desirable operating advantages:

- **You can install a non-clogging, tight-seating, corrosion and abrasion resisting, diaphragm valve suitable for corrosive liquids and gases.**
- **And at the same time obtain with it, dependable ASCO pilot control for automatic and remote closing and opening.**
- **With explosion-proof and watertight solenoid enclosures, if required.**

This valve can be installed in any position and is available normally open or normally closed. It controls flow in either direction. Wide selectivity in body and contact material provides bronze, stainless steel, cast iron, Saran and sanitary bodies, rubber or glass lined, etc. Pipe sizes: ½ to 2 inches; heights: 6 5/16 to 10 1/16"; face to face: 2 7/8 to 7".
This valve is but one of many ASCO Types, *all operating with automatic and remote control.* Write us in detail about your control problem. You'll be contacting "Electromagnetic Control Headquarters". This has been our business for close to seventy years.

If you would like a copy of our New Solenoid Valve Catalog, for your files, be sure to let us know.

ASCO Solenoid Valves

Automatic Switch Co.

381 LAKESIDE AVENUE · ORANGE, NEW JERSEY

FOR MEN WHO USE WIRE MESH BELTS!

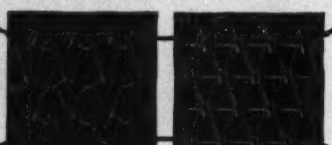
HERE'S WHY LEADING MANUFACTURERS SPECIFY "CAMBRIDGE" WIRE MESH CONVEYOR BELTS.

ACCURATE CONSTRUCTION—every step of the construction of your belt is carefully controlled so that the finished belt meets specifications for size, mesh count and mesh opening. Even the welds at the edge of the belt are specially inspected to give you maximum protection at this most vulnerable part of the belt.

RANGE OF SPECIFICATIONS—whether you're handling delicate lightweight loads, such as synthetic fibres, or heavy, bulky loads such as bagged cement, there's a Cambridge wire belt specification to meet your needs. Even processing through heat, cold or corrosive solutions is a snap when the proper metal or alloy is chosen for fabricating your belt.

EXPERIENCED ENGINEERING SERVICE—the combination of trained engineers both in the Cambridge plant and on our Sales Staff is your assurance that the belt recommended for you is the right belt. Cambridge engineers can assist you in any phase of conveyor belt usage . . . conveyor design, plant layout, equipment specifications, etc.

P. S.
IF YOU DON'T USE WIRE MESH BELTS, you'll do well to find out how they can cut costs and boost output by combining product movement with processing in your plant. For information write direct or call in your Cambridge field engineer. Look under "Belting-Mechanical" in your classified telephone directory for the Cambridge man nearest you.



Typical Cambridge Belt Weaves, Balanced and Rod-Reinforced, are widely used for many processes which can be combined with movement. Other Weaves available.

FREE WIRE BELT MANUAL
Gives data on design, installations, construction. Write for your copy now.

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For 70 years we've been weaving Wire Mesh. And a good part of that time we have also been making things of Wire Mesh for people who find it is cheaper, easier and generally more satisfactory to "let Jelliff do it."

From big Dipping Baskets to tiny precision filters — from fuel strainers to what-is-it gadgets — JELLIFF'S Custom Production Department turns out fabricated Wire-Mesh products at speed, price and precision that mean lower costs and a stronger competitive position for our many customers.

If you buy or make wire-mesh assemblies as components of your own products and have not yet had an estimate from Jelliff, write today for details. No obligation, even if you enclose a blueprint for us to figure on. Address Department 15.

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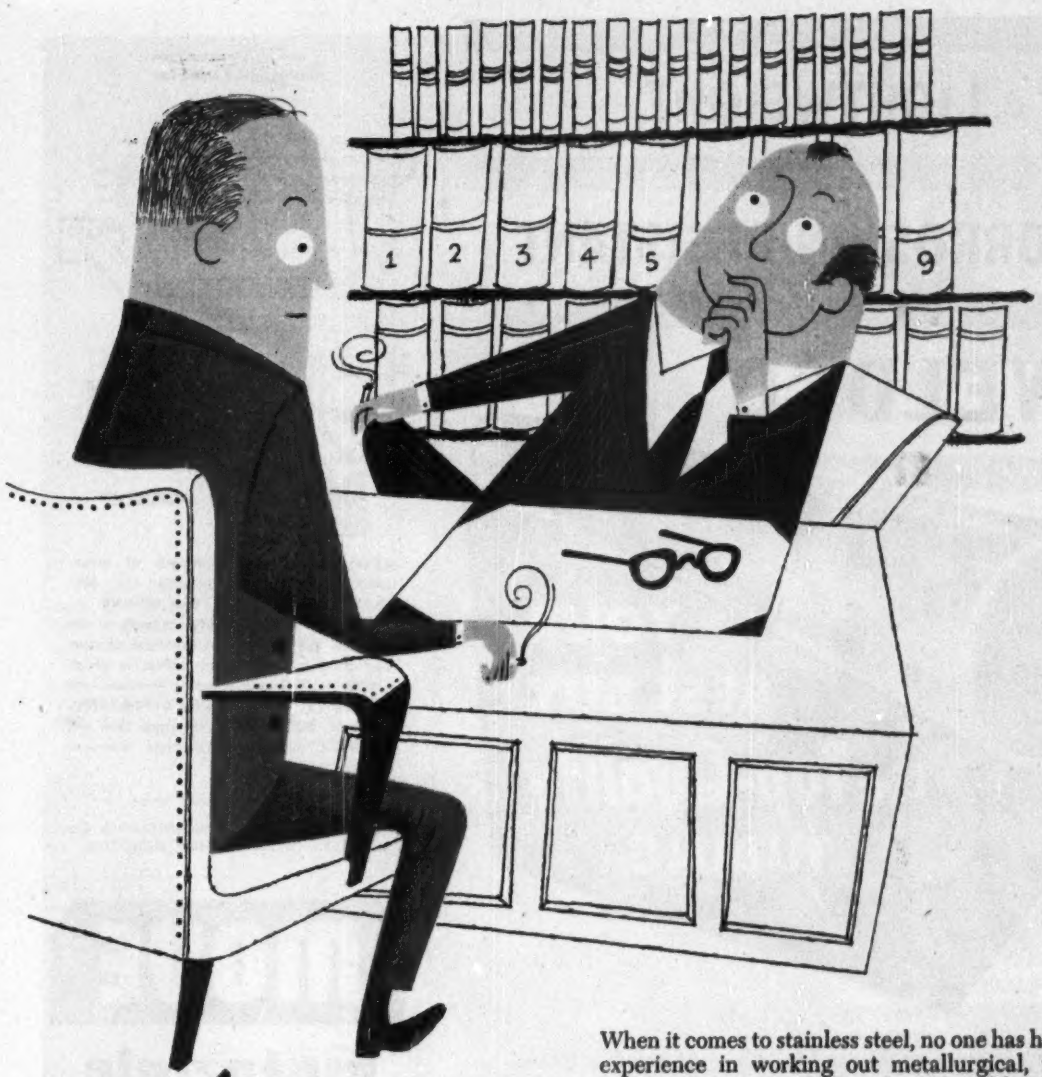
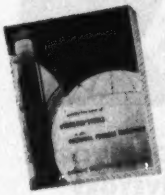


...and

go to a specialist for stainless



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When it comes to stainless steel, no one has had broader experience in working out metallurgical, fabrication and application problems than Crucible. Stainless is actually a group of *special* steels. And we have been the world's largest producer of all types of special steels for 53 years.

Our technical staffs and field representatives are available to help you select the grade, size or finish that is most practical and economical for your product or processing operation . . . with due consideration for fabricating problems as well as service use.

Besides our broad technical service, you get as fine a quality stainless steel as is made because Crucible REZISTAL stainless is produced in mills that were built exclusively for producing these corrosion and heat resistant steels.

So for competent technical advice and quality stainless, call Crucible.

CRUCIBLE first name in special purchase steels

53 years of Fine steelmaking **STAINLESS STEEL**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

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it's LIGHTWEIGHT

it's CORROSION-RESISTANT

it's WELDCO

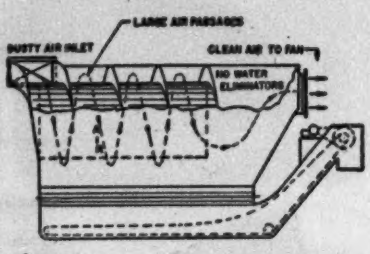
For any special problems—for all your regular tubing applications—Weldco gives you long, dependable service at the lowest possible cost. Weldco is highly resistant to corrosion, easy to fabricate, bend, form and weld. In addition, it offers a smooth inside finish, light weight, exceptional strength, and complete uniformity all the way through.

Weldco is available in Monel, Stainless, Inconel, Nickel and other alloys, in sizes from 3" to 30" O. D. Other sizes for special applications. Whenever you need light-weight, high-strength tubing, specify Weldco and be sure of getting the best.

Whatever Your Needs In Tubing . . . You're Way Ahead With WELDCO

THE YOUNGSTOWN WELDING & ENGINEERING CO.
3717 OAKWOOD AVE. • YOUNGSTOWN, OHIO

Air Tumbler



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IN INDUSTRY

NEW, yet tried in hundreds of diversified applications embracing the **MECHANICAL, CHEMICAL,** and **MINING** industries, the **AIR TUMBLER** exploits to the limit the old and proven principle of dust separation by centrifugal action to which it adds **WATER** as a trapping medium. Its **SIMPLICITY, EFFICIENCY, DEPENDABILITY,** and **ECONOMY** have made the **AIR TUMBLER** standard equipment wherever it has been tried.

For further information write to:

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P.O. BOX 67, LAKE ORION, MICHIGAN

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the BG way

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Barber-Greene
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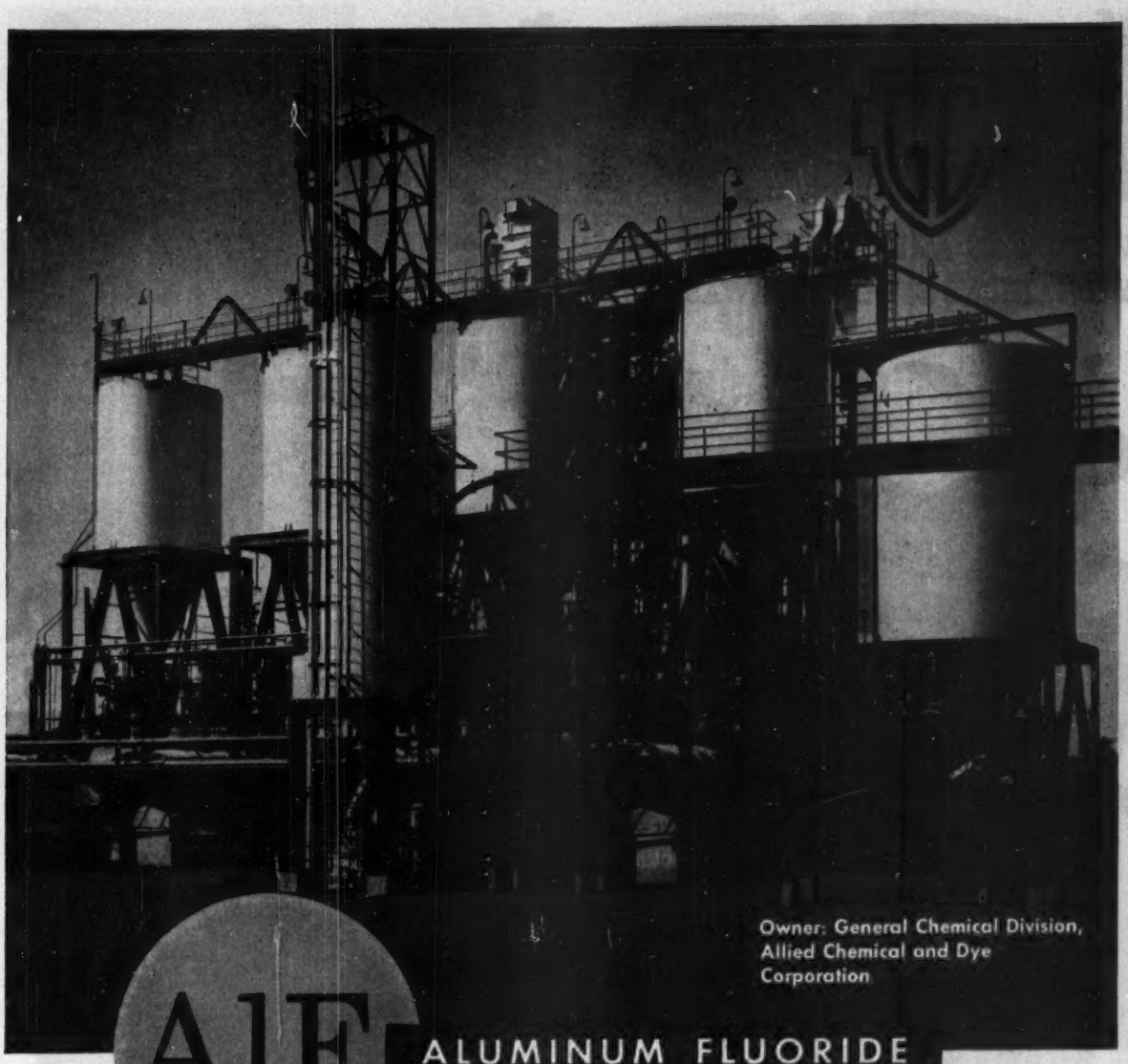

Owner: General Chemical Division, Allied Chemical and Dye Corporation

AlF_3 ALUMINUM FLUORIDE

on the double...

Fast engineering and construction schedules plus close cooperation from the client enabled this California plant to meet a pressing demand for aluminum fluoride.

By dividing work closely between coordinated project teams, Bechtel designs and builds rapidly—an important advantage to owners seeking early production from a new plant.

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WAS MAKING INDIVIDUALIZED CHEMICAL EQUIPMENT

Seventy-odd years ago when the A.S.M.E. was founded, KOVEN was already making Individualized Equipment to the chemical industry's most rigid standards. Today as through the decades, KOVEN's equipment achieves, for leading manufacturers, top quality, faster production and cost reductions. Each unit, designed to fit the most exacting needs, assures completely dependable performance. Call or write for a consultation — no obligation.

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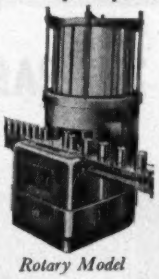
VACUFLOW

POWDER FILLERS

Cut Product Wastage. Vacuflow powder filling equipment operates on a principle of vacuum feeding, instead of pressure, to pack powder into a container.

Air is removed from the container to create a vacuum which draws a measured quantity of powder from the hopper. There is no problem with dust control, since the unique Vacuflow method simply does not involve air currents that cause dust.



Rotary Model

Model E

Semi-automatic models are available for filling containers ranging from the tiny talcum box up to and including 100 lb. paper bags and 200 lb. drums. Rotary models are available for automatic production of 5 lb. sizes or less at speed of 45 to 300 per minute.

Pneumatic is the one manufacturer in a position to furnish machines for making up complete production lines. Units are available for air cleaning, powder and liquid filling, capping and labeling a wide range of bottles, cans or jars.

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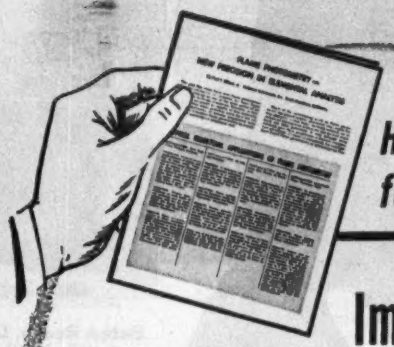


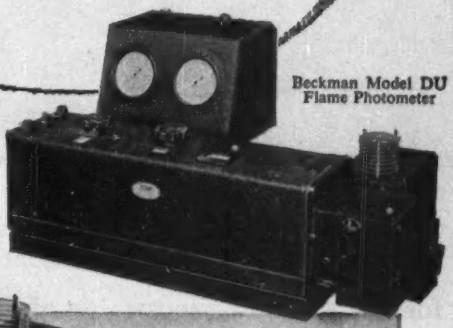
Helpful data for you...

Important Facts about Flame Photometry!

NOW, FOR THE FIRST TIME a prominent flame photometry consultant gives you the fine points to watch for in selecting flame photometry equipment.

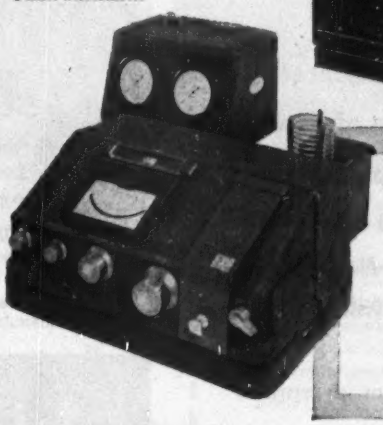
YOU LEARN WHY the monochromator is far superior to glass filters . . . why acetylene gas is better than city gas . . . why atomizer-burners are preferable to spray chambers. This bulletin gives the detection limits of more than 40 common and rare elements—*plus* a handy chart of emission characteristics for typical elements determinable by Beckman Flame Photometry equipment. It outlines typical applications in food, petrochemical, metallurgical, agricultural, biological, chemical and many other processing operations!

DISCOVER HOW YOU CAN FIND NEW PROFITS with Beckman Flame Photometry. This equipment is moving so rapidly to the forefront as one of the most useful of analytical tools that many potential users are not yet aware of the great savings, increased profit and quality obtainable with it. This bulletin describes these benefits and provides practical comparisons you can make to prove the superiority of Beckman Flame Photometers in your own operations.



Beckman Model DU
Flame Photometer

Beckman Model B
Flame Photometer



***FREE** . . . For your copy of this helpful bulletin which gives important facts about Flame Photometry — How, Where, When and Why it can bring new profits to your plant — see your nearest Beckman Dealer. Or write for Data File #24-14.*

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5340

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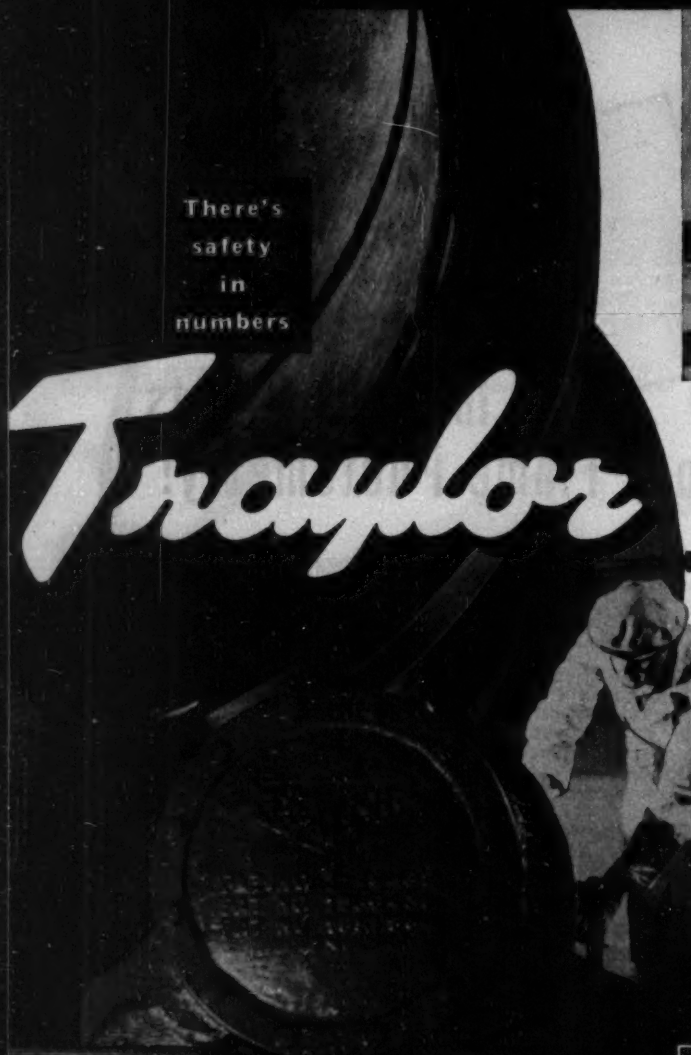
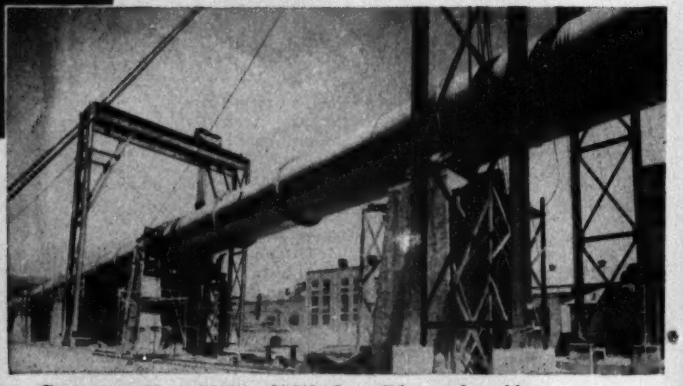


Baton Rouge, La. - 3 of 4 9'6" x 250'0" Traylor Kilns installed in the plant of a leading Cement Producer.

HAS BUILT 40 Rotary Kilns DURING THE PAST 2 YEARS



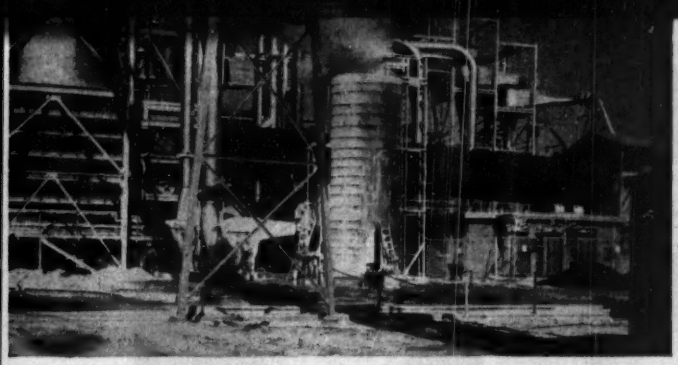
Covington, Va. - 11'0" x 350'0" Lime Kiln purchased by another leading paper maker for lime sludge recovery.

Palatka, Fla. - 7'0" x 200'0" Kiln in the plant of a paper manufacturer, used for lime sludge recovery.

Each Kiln individually "Traylored" for the efficient production of one of the following 13 different products.

Lime • Titanium Oxide • Bauxite • Cement • Sodium Silicate Dolomite • Iron Sulphide • Alumina • Sinter-Alumina • Calcium Chromate • Phosphate Rock • Lime Sludge • Diatomaceous Earth

A rotary kiln represents an important investment for any company. Leading producers all over the world have come to rely on Traylor's past experience to avoid future production headaches. Play it safe. Depend on the proven ability of Traylor engineers to assure the production you anticipate when expanding or modernizing your plant facilities.

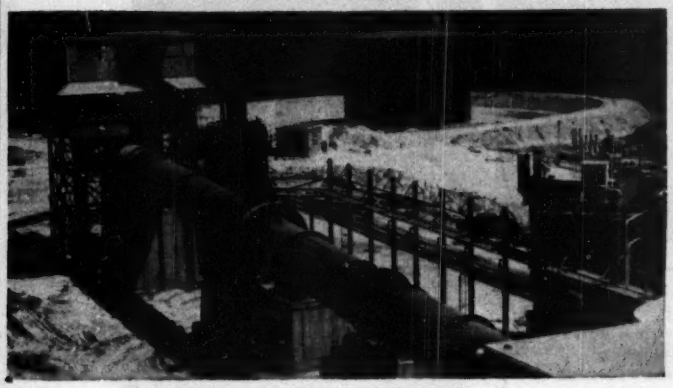


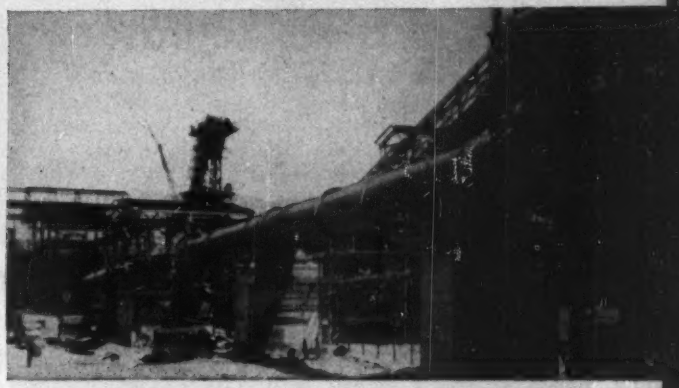
Lompoc, Calif. - An 11'0" x 100'0" Kiln producing Diatomaceous Earth.

Jamaica, B.W.I. - 9'0" x 175'0" Traylor Kiln used in the processing of Bauxite.

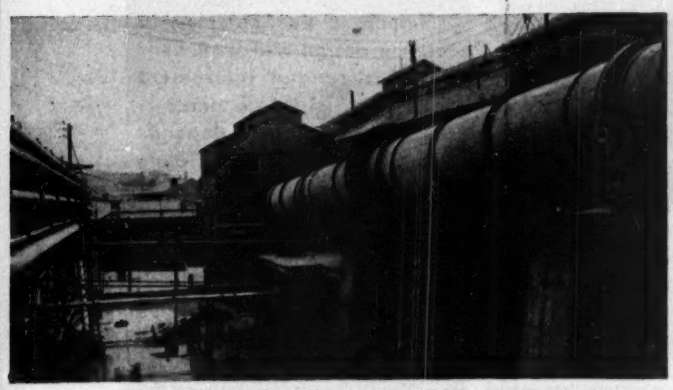
Acme, N.C. - Traylor 8'6" x 215'0" Lime Sludge Recovery Kiln in plant of well known paper manufacturer.

Chile, S.A. - 7'6" x 315'0" for calcining lime, used in the processing of copper ore.

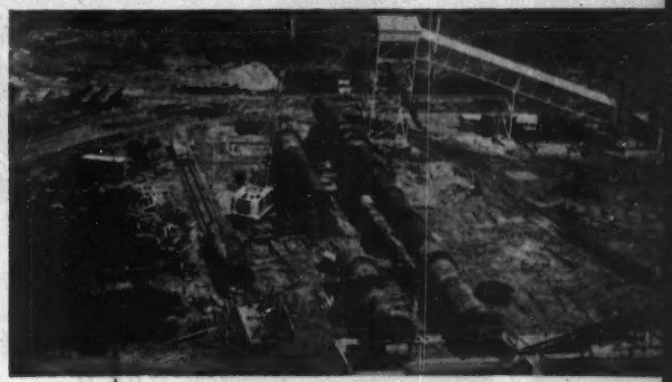




ranging in size from 7′ diameter up to 11′ diameter x 400′ long



Gardanne, France - 9'6" x 250'0" Rotary Kiln installed in the modern alumina plant of a well known overseas company.



Suriname, S.A. - Two of many Traylor Kilns installed in Latin America, these 8'0" x 120'0" kilns will be used in the production of Alumina.

A **Traylor** *Leads to Greater Profits*

York, Pa. - It took 7 flat cars to ship this 10' x 300', 3 section Traylor Kiln to this leading Dolomite producer.

Soon to be released! A new, fully illustrated, bulletin on Traylor Rotary Kilns is now in preparation. It will show the many superior features of Traylor Rotary Kiln design in detail. Mail the coupon today to be sure of getting up-to-date information you can't afford to miss.

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Title: _____

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High Pressure Gate Valve with Hydraulic Actuator.

Diaphragm valve with Air Actuator.

These actuators are for power operation of gate, plug diaphragm, and other line valves. They are pneumatically or hydraulically operated for direct or remote control. Designed as package units, they are mounted directly on the valves without need of special manifolds or outside supports. Easily, quickly and rigidly installed on new valves or on valves in service . . . *Prompt delivery.*

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VALVE ACTUATORS
AIR HYDRAULIC
PUMPS & BOOSTERS

with a

LIQUIDOMETER Tank Gauge

- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
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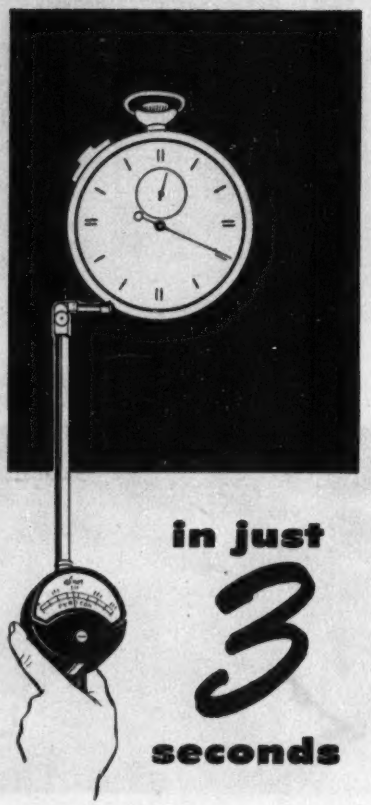
THE LIQUIDOMETER CORP.
36-29 SKILLMAN AVE., LONG ISLAND CITY I N.Y.



in just 3 seconds

. . . you can read any surface temperature in your plant . . . accurately and easily . . . with the Alnor Portable Pyrocon.

Compact in size, complete in precision design and workmanship, this rugged instrument assures the highest standards of speed, accuracy and dependability. You can take temperature readings on materials in process, the finished product or the heated equipment itself—in as few as 3 seconds!

Alnor Portable Pyrocons come in scale ranges to 2000° F., with thermocouples for every application. You'll find full details on the Pyrocon exactly suited to your operations in Bulletin 4257. Send for your copy now. Write: Illinois Testing Laboratories, Inc., Room 559, 420 North LaSalle Street, Chicago 10, Illinois.

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PRECISION INSTRUMENTS FOR EVERY INDUSTRY

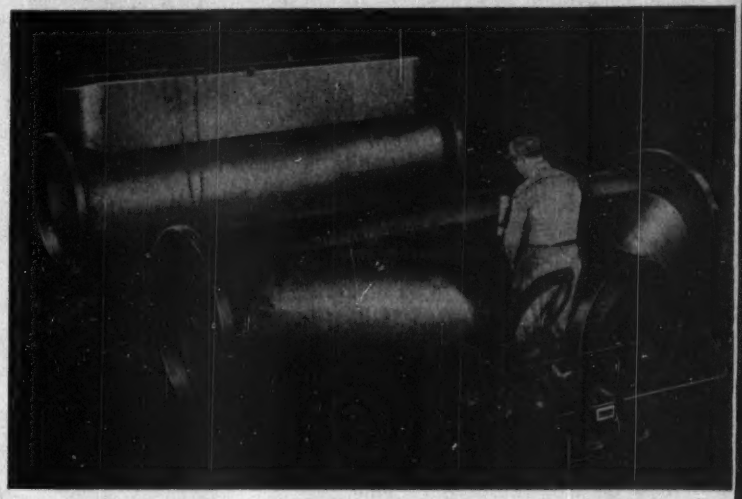
PROCESS EQUIPMENT NEWS

PUBLISHED BY FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY AUGUST 1953

Exchangers Headed for Sumatran, African and Domestic Plants

Undergoing hydrostatic tests and inspection prior to shipment is this group of exchangers (see below) headed for several domestic refinery sites. Others, now being fabricated, will soon be shipped to a refinery in Palembang, Sumatra, and to South Africa.

The exchangers scheduled for South Africa are most unusual in that they will handle products at temperatures up to 1775°F. Specially-developed for this particular operation, the five units are being fabricated in the U.S. by Kellogg because of the firm's extensive experience in the welding of high alloy equipment.



Tubes and tube-sheets of the exchanger are being fabricated of Type 310 stainless steel. The shells are insulated on both the inside and outside. When in service the units will be employed for pre-heating feed gas going to a reformer that produces reaction gas for the synthesis of gasoline.

Minimum Pressure-drop in Unusual High-Vacuum Condensers

These are the shells for two of four special vacuum condensers scheduled for installation this summer in a major Gulf Coast refinery. When in service they will condense the overhead from a vacuum tower which is part of a three-stage pipe-still now under construction.

They are designed to operate on the shell side at 53.5 mm of mercury. To obtain a minimum pressure drop of 1.65 mm, an unconventional design is used which permits a cross flow on the shell side.

Products Enter Through 36" Nozzle

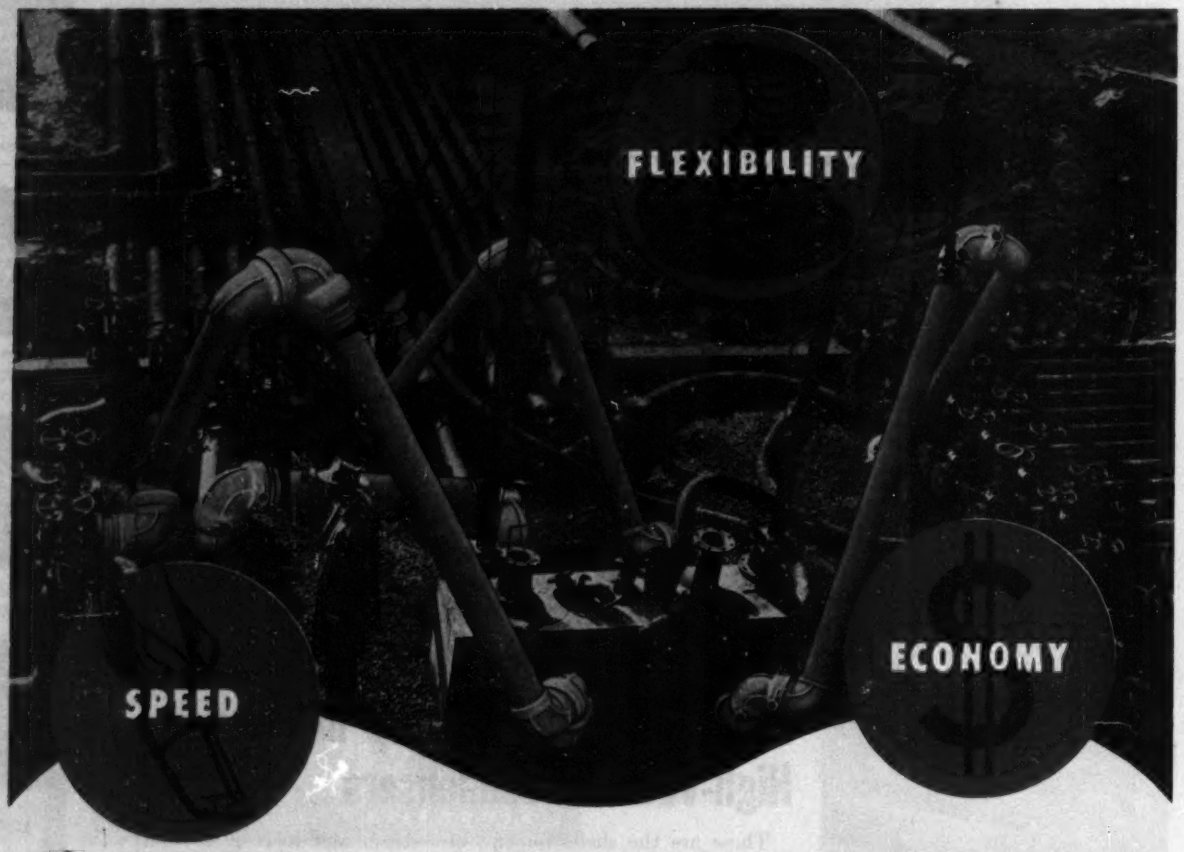
A mixture of hydrocarbons, steam and inert gases enters the first condenser through the 36-inch diameter nozzle shown in the photograph to the right of the welder. Temperature is reduced from 175°F to 93°F as it passes through the two condensers which are connected in series. In the process all of the hydrocarbon material and most of the steam is converted to a liquid state.

When completed, the 44-inch shells will contain 16-foot admiralty tubes on a 1¼" square pitch. Tube sheets will be of naval brass as will the tube supports. Remainder of these two-stage condensing units will be made of carbon steel.

FABRICATED PRODUCTS DIVISION
THE
M. W. KELLOGG
COMPANY
PULLMAN

INCREASED EXCHANGER CAPACITY . . .

SHOWN HERE is the shell fabrication section of Kellogg's heat exchanger facilities which has been streamlined for production-line manufacture of tubular heat transfer equipment. Other sections of the plant have also been rearranged and new fabricating equipment has been added to accelerate the production of the wide variety of units regularly coming into the shop.



CHIKSAN Swivel Joints illustrated in this installation, facilitate the speedy, economical handling of various fluids through 16 lines from loading dock to manifolding pit — a distance of 800 feet. Since each line leads to a separate tank through the manifold, cross contamination is eliminated.

CHIKSAN Swivel Joints in the pump manifold above enable operator to pull base stock from outside storage into the plant and direct flow to proper vessel or proportioner.

The Flow of Enterprise Relies on

CHIKSAN

Ball-Bearing Swivel Joints

CHIKSAN Manifolding Saves 3 Ways!

- √ ORIGINAL INSTALLATION
- √ NO CONTAMINATION LOSSES
- √ LOW COST OPERATION

Original cost of CHIKSAN flexible line manifolding installations often run as much as 50% less than fixed line manifolding operations which incorporate costly multiple valve and line systems.

A CHIKSAN manifolding operation is simplified in its entirety — providing complete flexibility, mobility and ease of operation in limited spaces.

CHIKSAN manifolding installations reduce line hook-up time — keep pit floor clear of lines thereby providing greater working areas.

CHIKSAN manifolding operations facilitate the transfer of all types of fluids safely and rapidly under extreme climatic conditions with no possibility of cross contamination.

CHIKSAN manifolding installations are specifically engineered for long life — easy and economical maintenance, and render years of trouble-free operation.

Our Engineering Research and Development Department will welcome inquiries on your manifolding problems.

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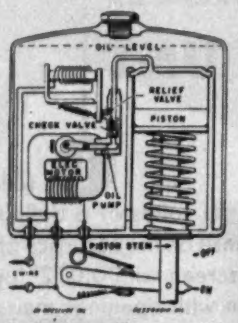
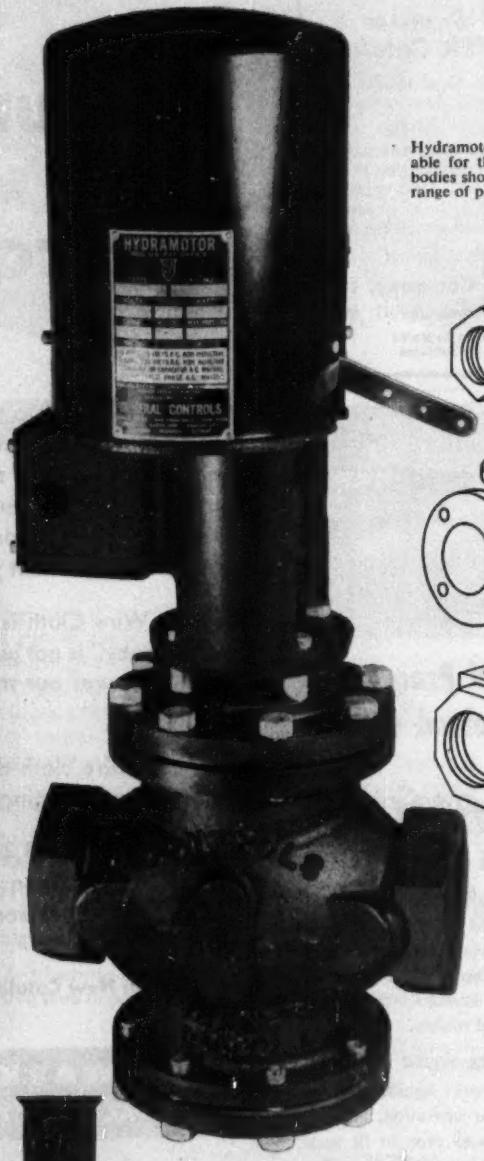
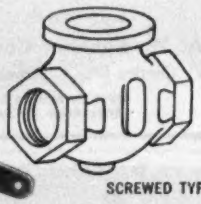
Featuring two-wire, positive, automatic shut-off in case of current failure, General Controls' Hydramotor* Valves perform dependably under all kinds of pressure, temperature and flow conditions. Lifetime-sealed in oil against dust, grit and weather, the Hydramotor operating mechanism applies electro-hydraulic power direct to the valve, thus eliminating the need for a complicated gear train. With only three moving parts, General Controls' Hydramotor* Valves require no lubrication or maintenance. For safe, economical, all-weather control of gases, oils, steam and heavy viscous liquids, the *best* valve is a General Controls Hydramotor.*



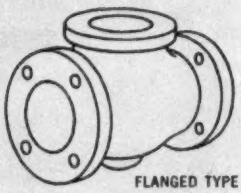
There are no gears in the Hydramotor* operator mechanism. A motor-driven hydraulic pump actuates a piston in a control cylinder, moving the main valve with maximum mechanical efficiency. Valve will handle line pressure up to 3000 psi.



Hydramotor operators are available for the basic types of valve bodies shown below with complete range of pipe sizes from ⅜" to 6"



SCREWED TYPE



FLANGED TYPE

SAUNDERS TYPE

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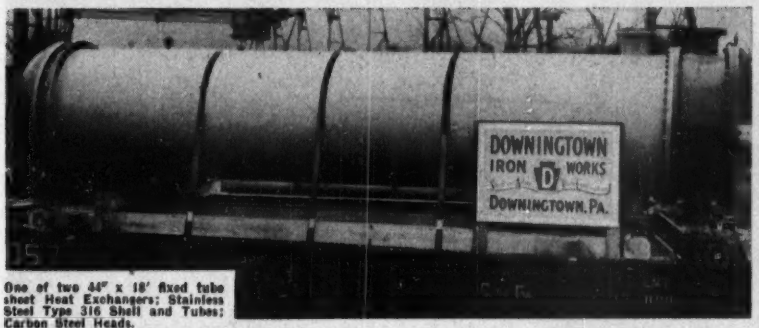
and ANOTHER FINE HEAT EXCHANGER



One of two 44" x 18' fixed tube sheet Heat Exchangers; Stainless Steel Type 316 Shell and Tubes; Carbon Steel Heads.

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DOWNINGTOWN is experienced in building equipment with Bi-metallic, Finned Tube and Karbate Graphite.

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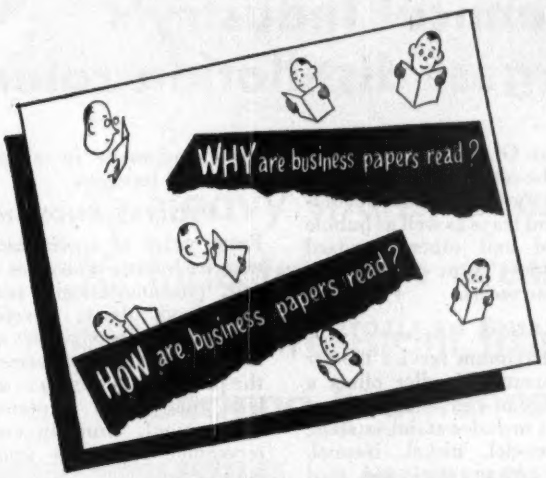

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Presents a fresh coverage of modern chemical engineering fundamentals and practice—30 big sections, more than 140 contributors. Takes up recent developments, new procedures, new equipment. Gives quick answers to many problems; thousands of tables, formulas, and diagrams. Brings you up to date on unit processes, design, and practice. For practicing engineers, executives, plant or laboratory workers, or mechanical engineers, it provides answers to countless questions. Edited by John H. Perry, Tech. Investigator, E. I. duPont de Nemours & Co. Third Edition, 1942 pp., 2057 illus., $17.00.

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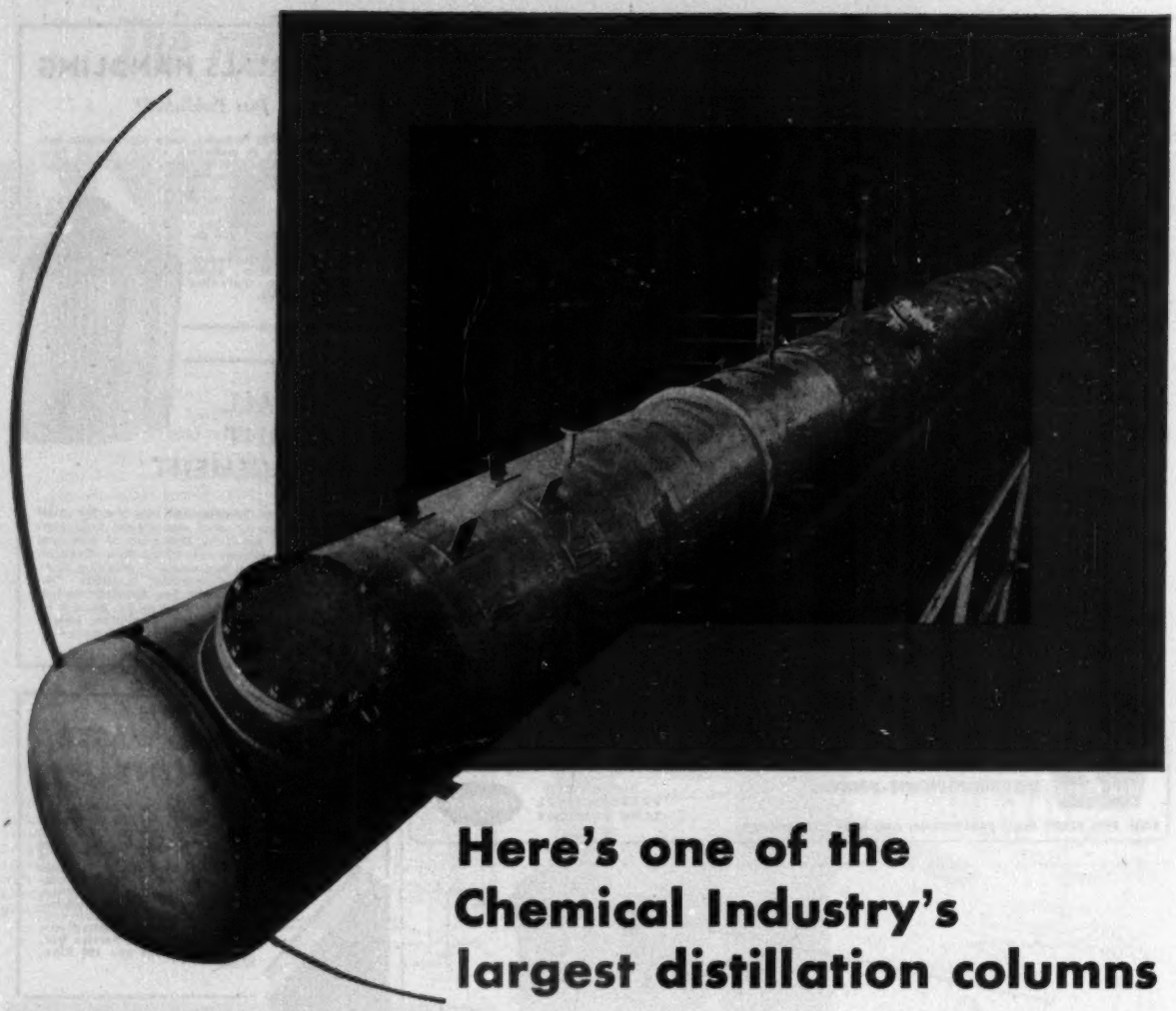

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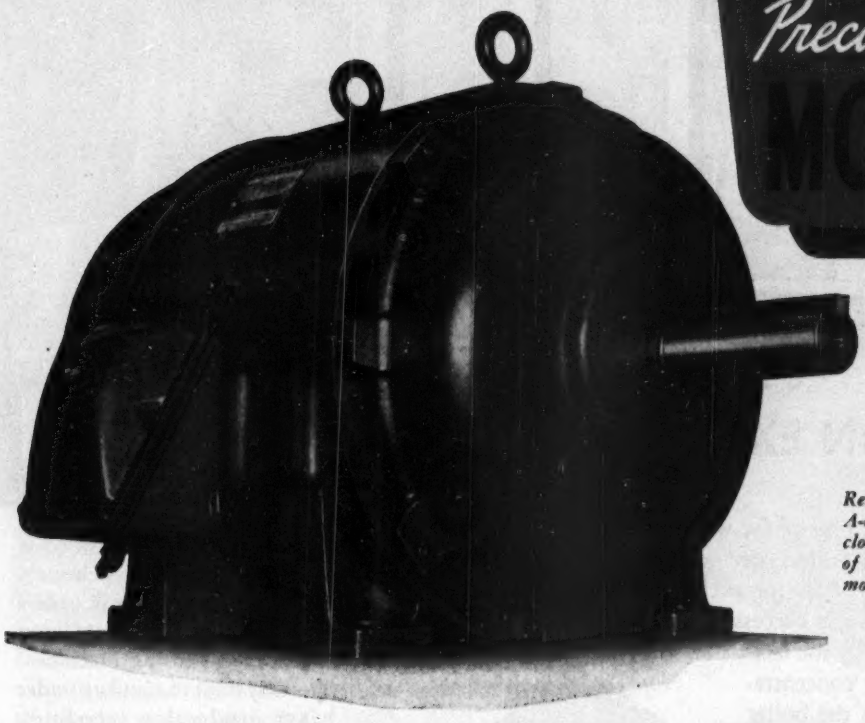

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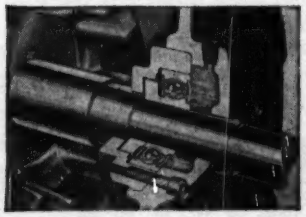

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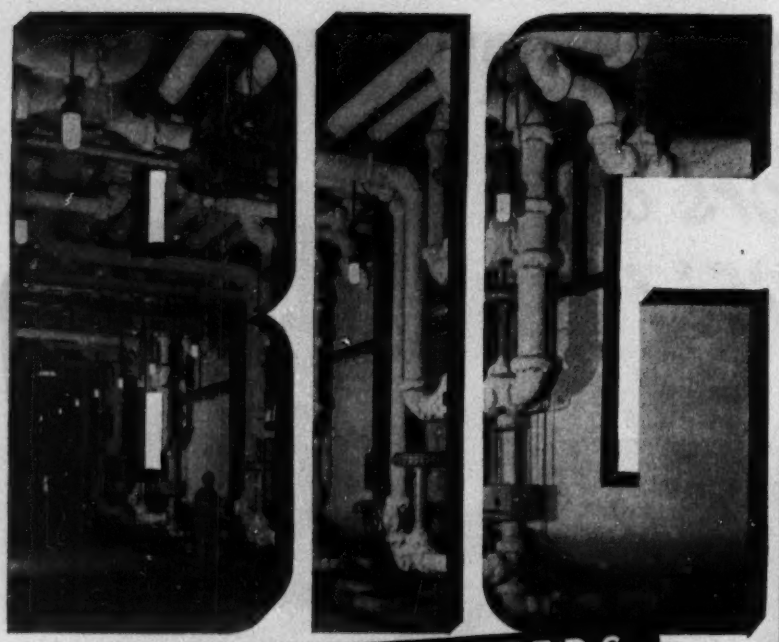
The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1[illegible]

RELIANCE ELECTRIC AND ENGINEERING CO.

[illegible] Sales Representatives in Principal Cities



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A new edition of Nalco Bulletin 57 gives technical data on Nalcite SAR and Nalcite SBR anion exchangers . . . includes complete up-to-the-minute information on silica removal. Write for your copy today.

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PRODUCTS • *When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.*

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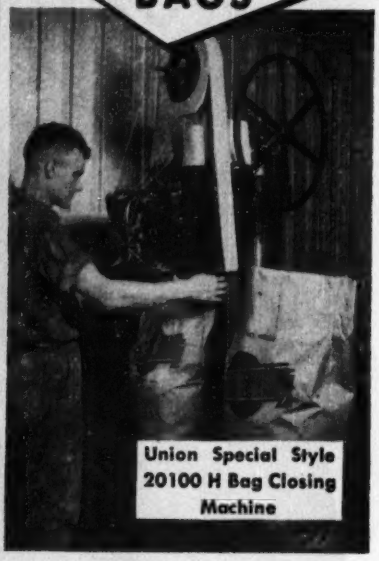

Union Special Style 20100 H Bag Closing Machine

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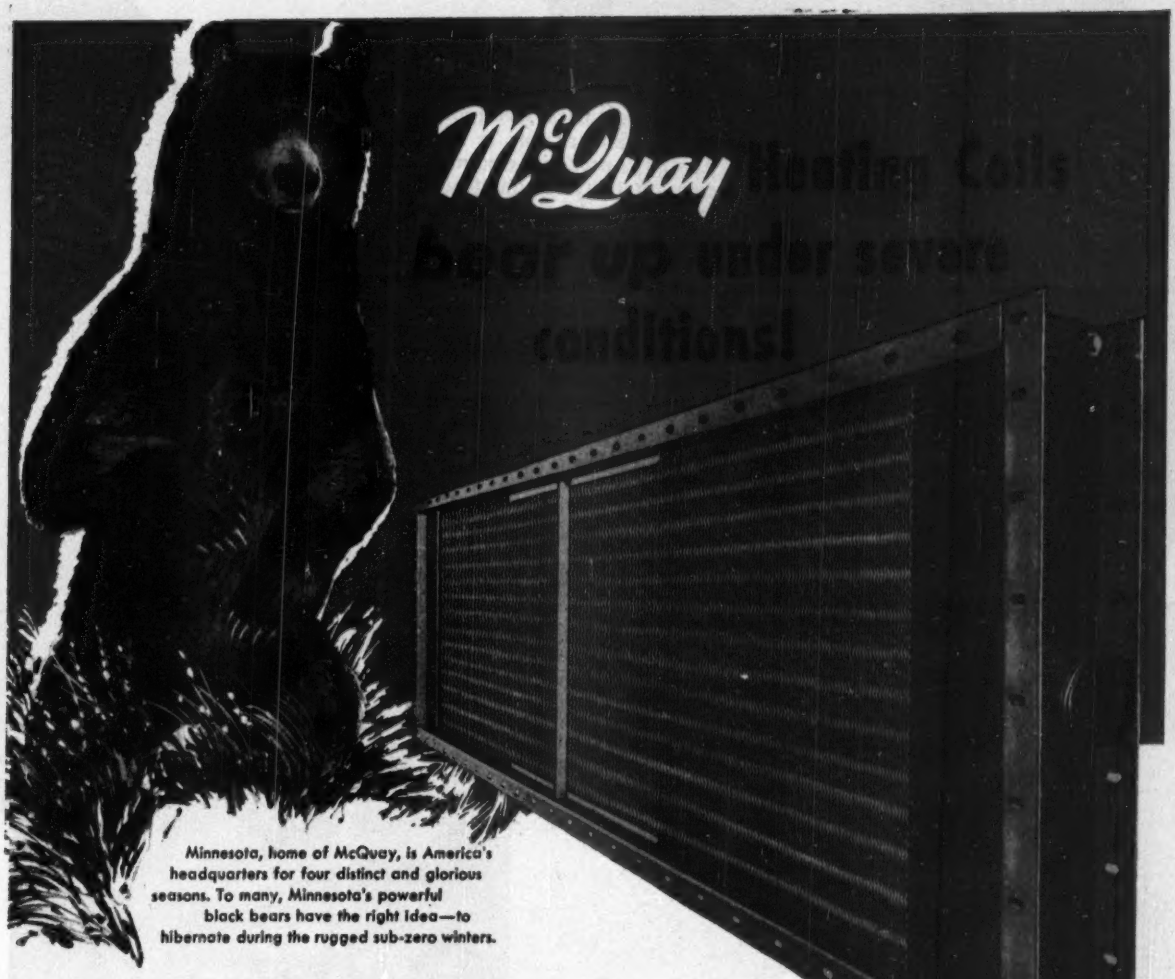
SEND FOR THIS BULLETIN!

It's easy to find just the right unit to meet your individual needs in Union Special's big line of bag closing machines. Ask for a copy of Bulletin No. 409, "UNION SPECIAL FILLED BAG CLOSING MACHINES."

Union Special
MACHINE COMPANY



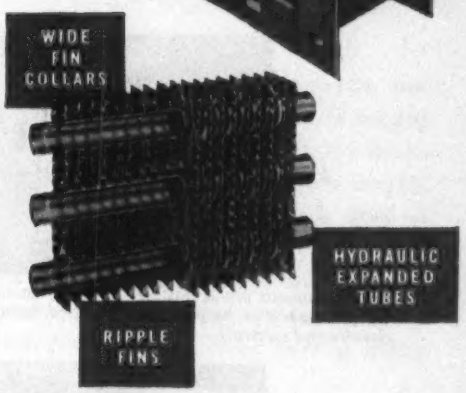
Minnesota, home of McQuay, is America's headquarters for four distinct and glorious seasons. To many, Minnesota's powerful black bears have the right idea—to hibernate during the rugged sub-zero winters.

By specifying McQuay equipment, you can assure your customers that there will be no need for them to go into hibernation or to migrate to the south.

Ripple Fin coil construction, an exclusive McQuay feature, is the product of years of research aimed at producing the ultimate in heat transfer for any weight metal. High efficiency is assured by forcing the air to follow an ever-changing direction of flow in passing through the coil. Thus the air repeatedly contacts the coil surface to give maximum contact time, maximum contact velocity, and a resultant optimum heat transfer.

The staggered tube and rippled edge features also contribute greatly to the construction ruggedness of the famous McQuay line.

McQuay heating coils are available in a wide variety of styles and sizes. Hot water, cold water, brine, direct expansion, and refrigerant condensing coils are available for practically every type of application. Write McQuay Inc., 1622 Broadway St. N.E., Minneapolis 13, Minnesota. Representatives in principal cities.



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Process control
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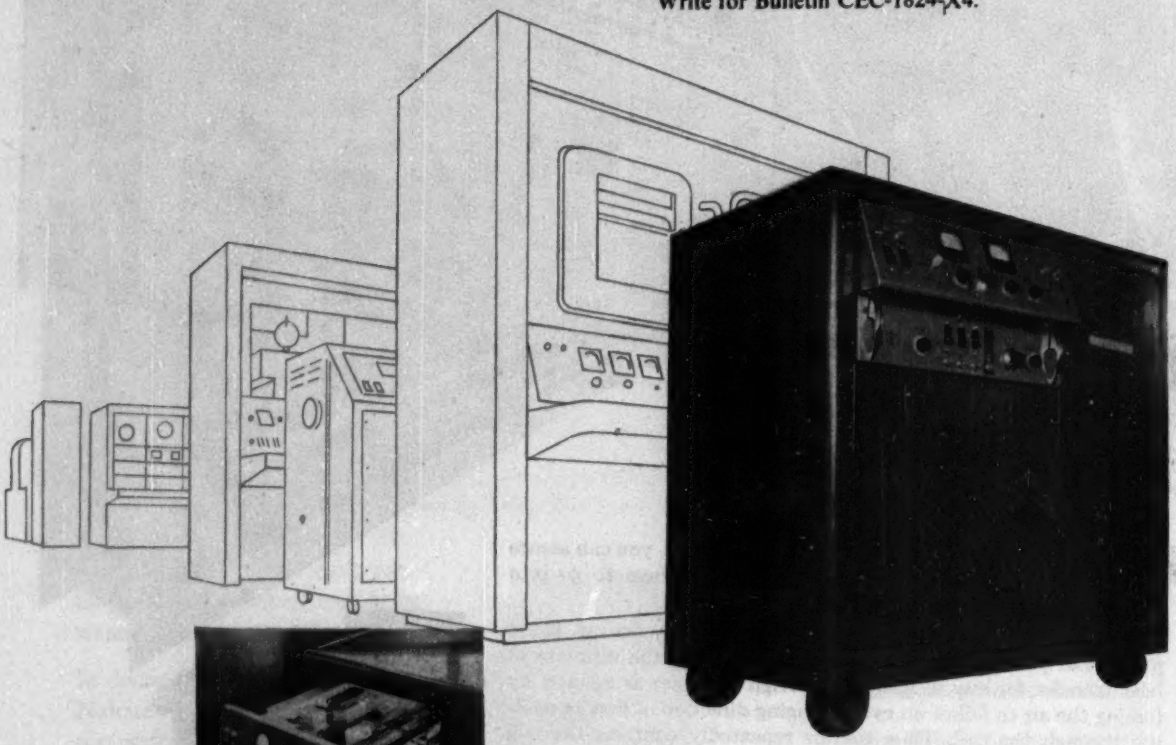
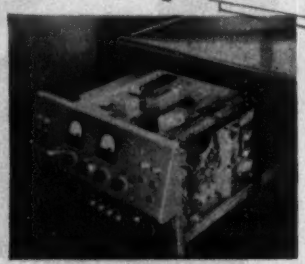
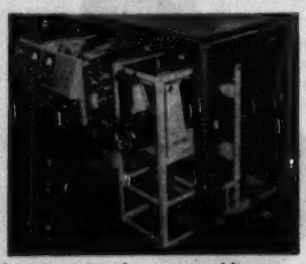
THE latest mass spectrometer in America's accepted standard line is the Consolidated Model 21-610, a precision electronic instrument with extreme stability for unattended process monitoring in the petro-chemical industries. Used with a hand-held probe it operates as a detector for tracing leaks of any gas within its mass range. The Model 21-610 is suitable for qualitative and quantitative component determinations in gaseous and light-liquid mixtures. Moderately priced and economical to operate, needing no expensive refrigerants, this new instrument brings mass spectrometry as a control procedure within reach of small refineries and chemical manufacturers.

Write for Bulletin CEC-1824-X4.





All components are accessible: either by removing side panels or by pull-out chassis containing circuits and controls.



Electronic and vacuum/analyzer assemblies may be removed intact and operated independently.

Model 21-610 Mass Spectrometer

Consolidated Engineering
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300 North Sierra Madre Villa, Pasadena 15, California

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Engineered FOR ACCURATE FIT-UP

THIS TUBE-TURN Welding Return is engineered for shape, size and wall thickness to simplify piping installation. It is forged by the only process that produces a wall as uniform in thickness and true in circularity as the original seamless pipe. This assures accurate fit-up and perfect alignment . . . whether it is used as a full 180° return or cut to any odd angle.

When you specify TUBE-TURN Welding Fittings and Flanges, you are *sure* of getting the ultimate in piping simplicity, safety and permanently leakproof construction. Your nearby TUBE TURNS' Distributor is at your service!

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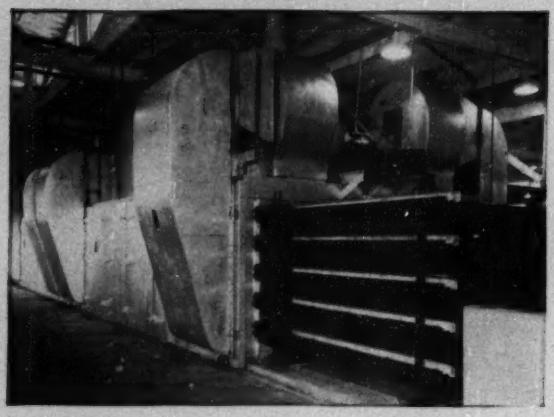
HART'S SERVICE

TUBE TURNS' *Engineering Service*
HELPS IMPROVE A DRYER DESIGN

C. B. McLaughlin, manager of TUBE TURNS' Engineering Service Division has been working with designers and piping men in the field for years. He and his men are at your service.

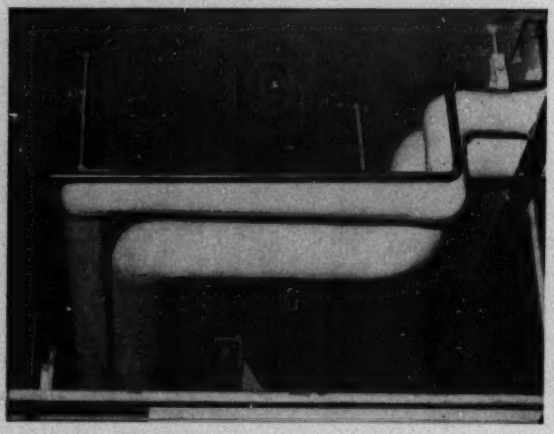
WHERE PIPING is a component of plant equipment, more and more designers are using TUBE-TURN Welding Fittings for directional changes. Results: greater design flexibility, reduced maintenance, less weight and space, improved operation. An example is the veneer dryer shown . . . a product of Coe Manufacturing Company, Painesville, Ohio. Progressive engineers of Coe, with the help of TUBE TURNS' Engineering Service Division, converted the heater from screwed connections to welded construction. Each of its banks of 1-inch pipes is joined by 180° TUBE-TURN Welding Returns. The coils carry steam at 200 psi pressure and 388°F. Joints are now permanently leakproof.

TUBE TURNS' Engineering Service is available to help in *your* piping problems.

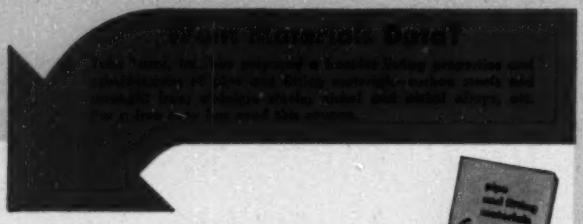


Coe Veneer Dryer. Welded coils with TUBE-TURN Welding Returns are compact and permanently tight.

YOUR DISTRIBUTOR of TUBE-TURN Welding Fittings and Flanges can serve you promptly. He is backed up by the entire TUBE TURNS' organization.



AT UPJOHN, Kalamazoo, Mich. Directional changes in piping are made with TUBE-TURN Welding Fittings. Many lines are stainless steel to guard purity in processing.



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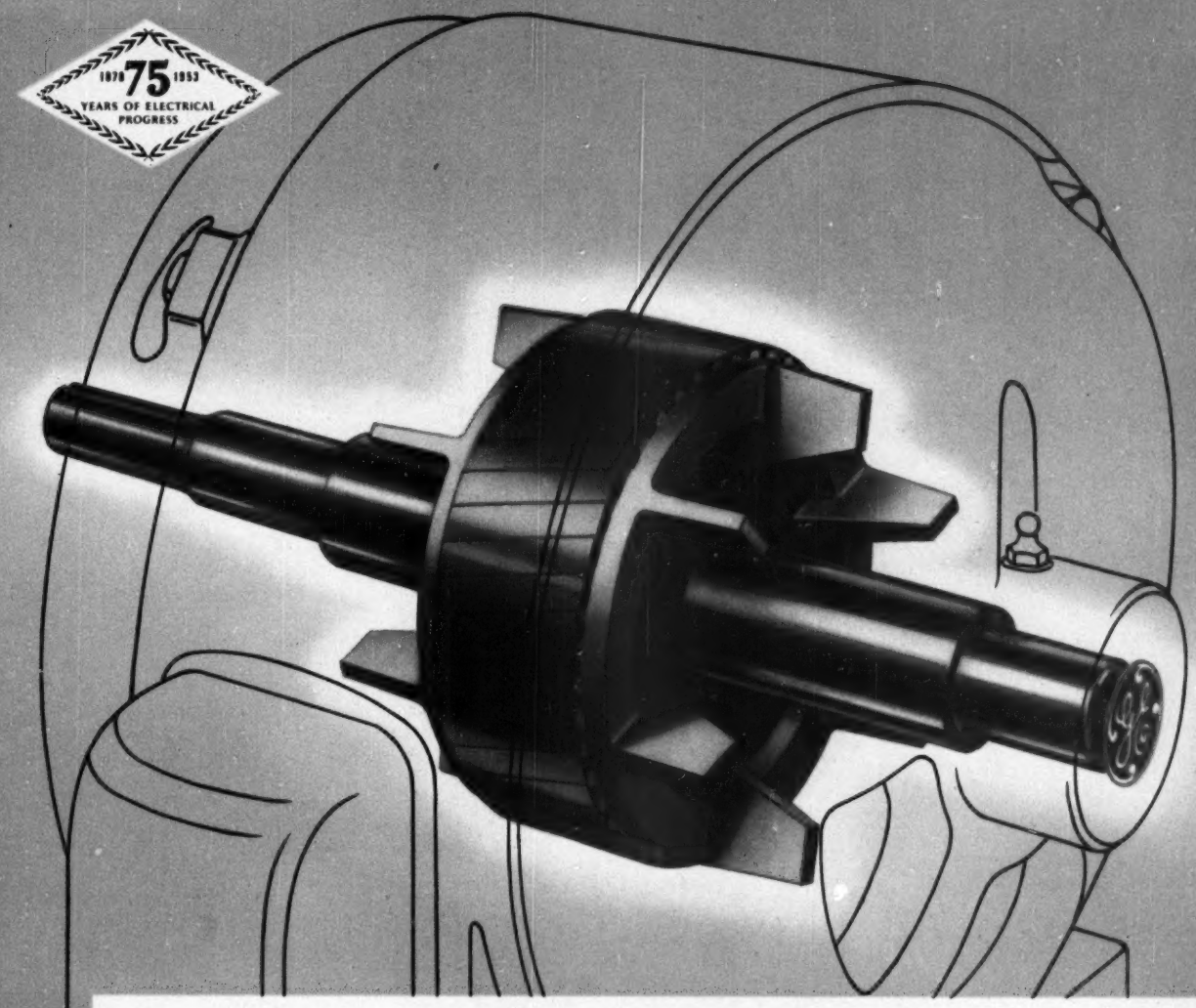

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G-E pioneering and research developed and produced this one piece cast-aluminum rotor winding, which has virtually eliminated rotor failures in Tri-Clad motors.

Rotor is indestructible in service because the bars, end rings, and fans are a "one-piece" casting. No brazed joints, no fabricated fans to come apart.

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Rotor efficiency is higher, operating losses reduced, as the result of a special chemical treatment.

The motor runs cooler because the integrally cast fans dissipate heat faster.

Operation is smooth and quiet due to the dynamic balancing of the rotor which also reduces bearing wear and material fatigue.

Long rotor life is one more reason why G-E Tri-Clad motors last longer — give you more reliable service and greater operating economy.

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BRIDGEPORT BRASS COMPANY

COPPER ALLOY BULLETIN

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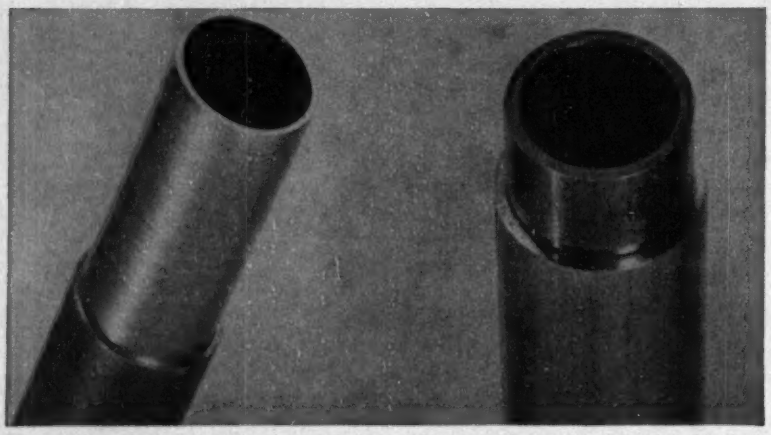


Duplex Tubes are double walled—composed of two different metals specially designed to fight both inside and outside corrosion. For example, in ammonia refrigeration systems, steel to the ammonia side and copper or a copper-base alloy to the water or brine side increases heat transfer rate and extends service life with reduced maintenance.

Improving Ammonia Refrigeration Systems With Duplex Tubing

Since ammonia and similar nitrogen compounds are finding greater applications in refrigeration, synthetic chemical compounds and as liquid fertilizers, it is important that we learn how to handle these corrosive gases and liquids.

Dry ammonia gas is not corrosive to most metals and alloys. However, when ammonia is mixed with water and air (oxygen), it severely attacks copper and copper-base alloys.

On the other hand, steels are very resistant to ammonia corrosion. This explains their wide use in the construction of equipment and heat exchangers for producing and handling ammonia and its compounds. The presence of salts such as ammonium nitrate increases the corrosivity of ammonia towards iron, aluminum, zinc, and cadmium.

Ammonia Refrigeration

Corrosion from the water or brine side has always plagued operators of ammonia refrigeration systems. Steel tubes have long been used with ammonia and are satisfactory in withstanding corrosion from the ammonia side, but on the water side rust quickly builds up a heat insulating layer which must be removed from time to time at considerable cost. This is now being overcome through the wider use of Duplex tubes composed of low carbon steel to the ammonia side and copper or copper-base alloys, which stand up well, to the water side.

The most popular Duplex tube combinations are low carbon steel outside and copper, Admiralty, or Red Brass inside towards waters from rivers, lakes, ponds, or wells. When sea water is used for cooling purposes, Duplex Tubing with Cupro Nickel, Duronze IV (arsenical aluminum bronze), Aluminum Brass, and Admiralty are popular. Where high water velocities may cause impingement corrosion, the first three mentioned alloys are superior to Admiralty.

Improved Heat Transfer with Lower Maintenance

Mechanical bonding between the two components of Duplex tubes is so tight that very satisfactory heat transfer characteristics result. The designer can use the fouling factor for copper or copper-base alloys rather than the higher value customarily used for steel. Slime, algae, and marine growths have less tendency to foul copper-base alloys than steel. The use of copper or copper alloys on the water side results in continued high heat transfer characteristics compared to single wall steel tubes whose heat transfer value becomes lower as a thicker insulating coat of rust builds up.

For these reasons smaller size heat exchangers, equipped with Duplex tubes, can be designed to have the same total heat transfer as larger size units with steel tubes. Also, when steel tubes are replaced with Duplex (steel/copper), the improved heat transfer rates result in higher operating efficiency.

An ice company that replaced its steel tubes with Duplex (steel/Admiralty) reported two years later that four semi-annual back-breaking cleanings have been avoided; operating pressures are running 15 to 20 pounds lower; and that their new Duplex tubes have already paid for themselves.

A leak at the tube sheet is dangerous, if not soon corrected, as it may permit sufficient ammonia to contaminate the cooling water or brine, accelerating corrosion of the copper or copper-base alloy component of the Duplex Tubing. Corrosion from contaminated water is most severe at the inlet end of the tubes where turbulence is highest.

Duplex Has Many Advantages

The use of Duplex tubes has increased greatly during recent years because of the following factors:

1. They do an excellent job where a dual corrosion problem is involved.
2. Reduce maintenance, shutdown time and labor.
3. Conserve metals since corrosion rates are greatly reduced.
4. Resist corrosion from untreated and treated waters better than steels.
5. Improve heat transfer characteristics or higher efficiency as compared with single-wall ferrous alloys.

If you have a corrosion problem that is difficult to handle, consult our Corrosion Laboratory. It is quite possible that there is a Duplex Tubing combination which is the answer to your problem. Write for the "Duplex Tubing Technical Bulletin No. 1950." (359)

"Advertisement"

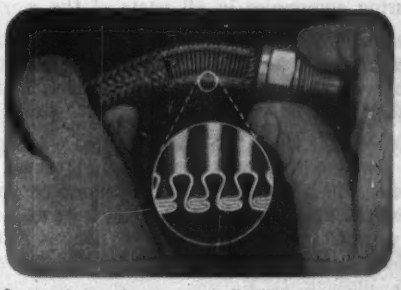
EXPANSION-CONTRACTION-VIBRATION...

Here are 3 Ways to Cure Them!

These are the right connections—wherever there's *unwanted motion* —or critical temperature, pressure, vacuum or corrosive action.

TITEFLEX®
All-Metal
Flexible Hose

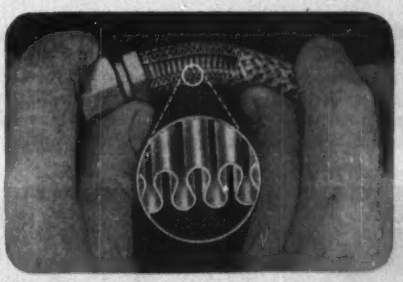
stands up to conditions that would ruin rigid tubing. You can use it for scores of ticklish jobs . . . Connect misaligned or moving parts of machinery. Absorb vibration, or pulsation. Transmit vacuums, shield wires and cables against electrical or electronic interference. Handle difficult gases, vapors or liquids—from ammonia to acid to sea-water to steam. There's more than one application in your plant *right now* that needs TITEFLEX.



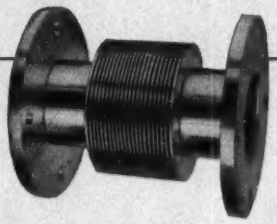
Sectional view shows rugged, flexible, seamed construction of Titeflex.

UNIFLEX
Helically-Corrugated
Seamless Flexible Tube

is tough, corrosion-resistant, leakproof. Use it in applications too tough for ordinary concentric tubing. For example, oil burners, hydraulic lines, air conditioning equipment, refrigeration machinery, pumps, compressors, diesels and machine tools. Metal-to-metal seat of UNIFLEX fittings assures leakless service. Helical, seamless wall structure gives it greater flexibility and longer life. Thoroughly tested in service, UNIFLEX offers real advantages where conventional tubing gives trouble.

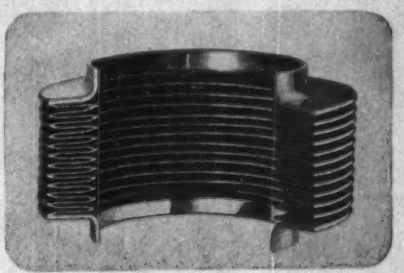


Note the helically-corrugated, seamless wall structure of Uniflex.



TITEFLEX BELLOWS

have unique, welded, convoluted-diaphragm construction. They absorb lineal movement in many types of equipment—*without* weakening lines and without reducing the flow rates of gases or liquids being conveyed. Use TITEFLEX Bellows to accommodate lineal contraction and expansion or high frequency vibration, to seal high pressure valves and shafts, or to handle gases and corrosive liquids at high temperatures. For special applications, special designs can be furnished. Complete bellows assemblies can be supplied with any required types of fittings.



Cross-section shows the welded, convoluted-diaphragm construction of Titeflex Bellows.

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On these pages are five examples of the variety of heavy-metal equipment designed and built by Alco to solve scores of new industrial problems. Each was made possible by two important factors.

First: Alco is thoroughly familiar with industry's needs. Its designers and engineers have worked closely for many years with power, petroleum, chemical and manufacturing companies in all parts of the world.

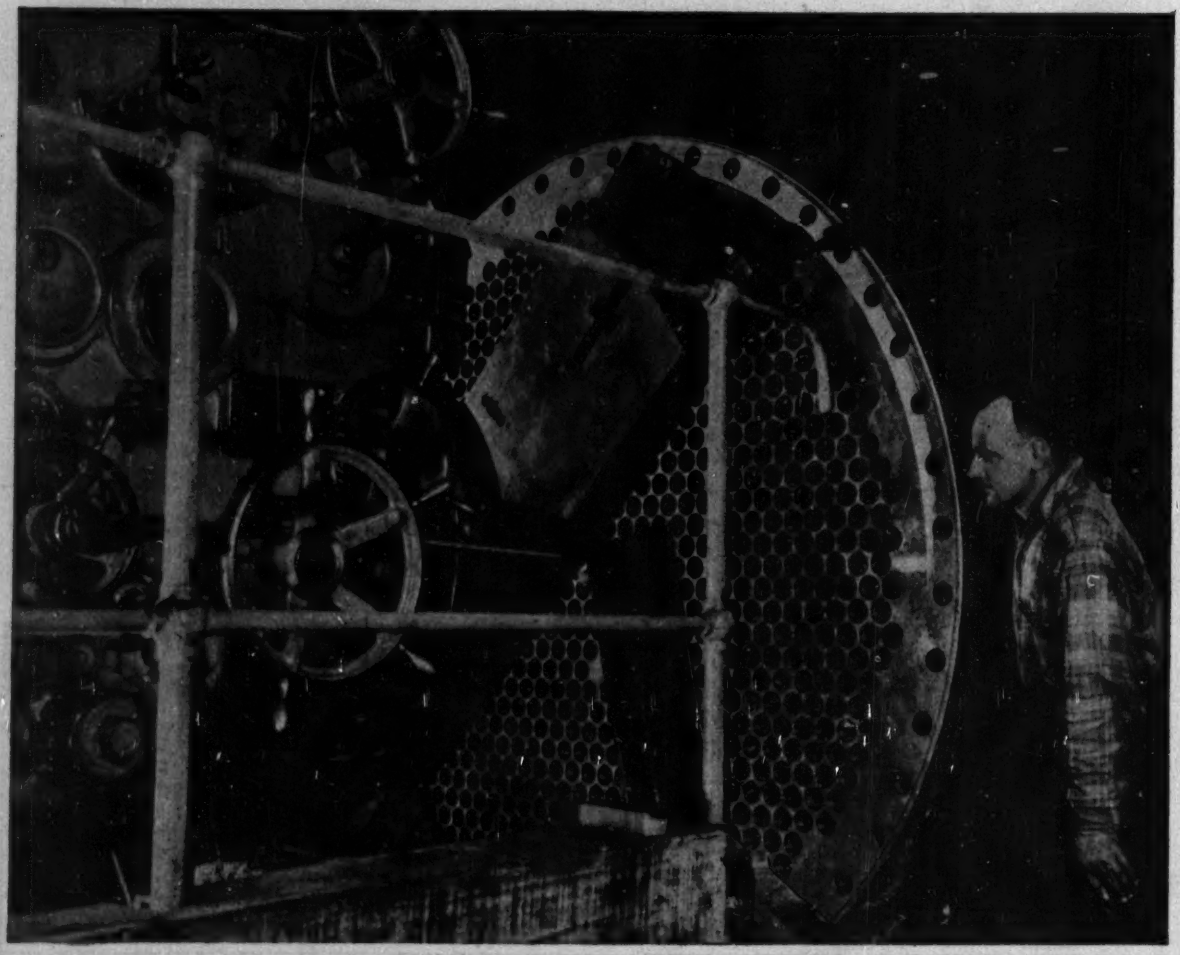
Second: Alco has the complete production and testing facilities required to handle efficiently and economically nearly every type of metal fabricating operation.

Remember these factors next time you have a problem that calls for something extra in heavy-metal equipment. Then contact your nearest Alco Products Sales Engineer at New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa or Beaumont; or write direct to Dunkirk, N. Y.

How ALCO designs

Answers to

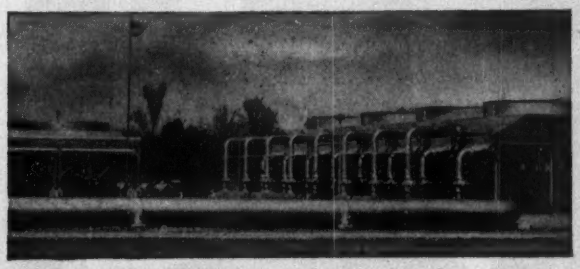
Alco



COMPLETE PRODUCTION FACILITIES, backed by years of experience, enable Alco to fabricate all types of heavy-duty power and processing equipment to meet virtually any specifications. Shown here is a specially designed flange-facing machine in operation at Alco's 31-acre Dunkirk plant.

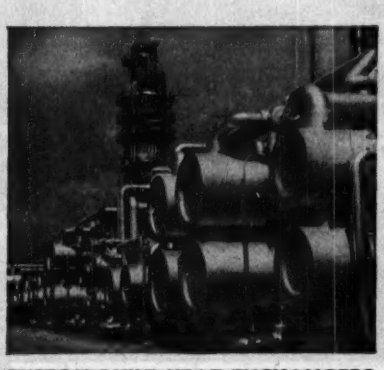
and builds...

New Industrial Problems

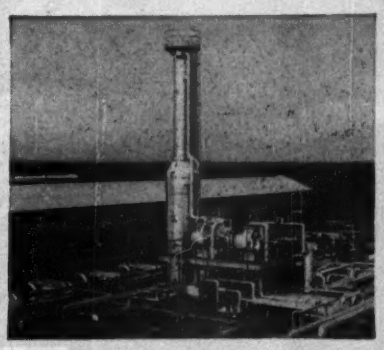


ALCO AIRCOOLERS—the economical answer to a wide range of cooling problems—handle a major part of the heat dissipation at Transcontinental Gas Pipeline Company's modern compressor station at Spartansburg, S. C. Transco also installed these versatile Alco units at their stations near Comer, Ga., and Reidsville, N.C.

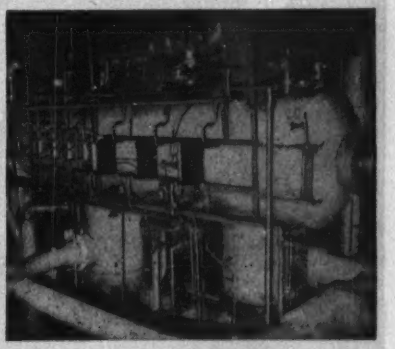
ALCO ELECTRIC WELDED STEEL PIPE, available in diameters up to 120 in., is now giving low-cost, high-capacity service in water, gas, oil and sewer installations throughout the country. Furnished in sizes limited only by shipping considerations, Alco pipe helps cut installation time to an absolute minimum.



CUSTOM-BUILT HEAT EXCHANGERS were among the variety of Alco equipment specified for Esso Petroleum Company Limited's giant new refinery at Fawley, England. The largest refinery in Europe, Fawley produces fuels, solvents, lubricating oils and other products at the rate of over 6,000,000 tons a year.



DE-ETHANIZER TOWER was built by Alco to meet the strict requirements of Tennessee Gas Transmission Company's new gas processing plant at Gabe, Kentucky. Years of experience and the most modern manufacturing facilities enable Alco to produce heavy-metal equipment for nearly every purpose.



FLEX-TUBE EVAPORATORS at Florida Power Corporation's Bayboro plant at St. Petersburg, Florida, produce 7000 pounds per hour of vapor with a guaranteed purity of 0.9 ppm, based on 2480 ppm shell concentrate. Removal of scale on tube surfaces is greatly facilitated by Alco's patented Flex-Tube construction.

ALCO

ALCO PRODUCTS DIVISION

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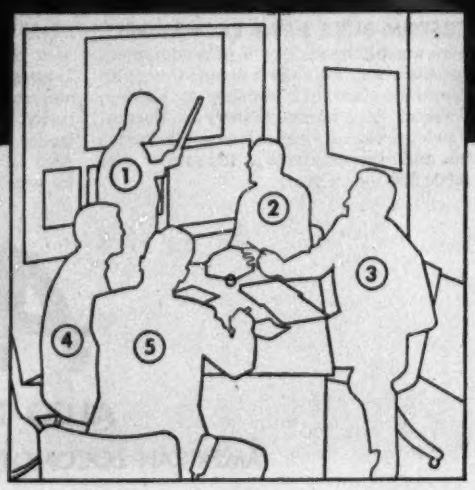

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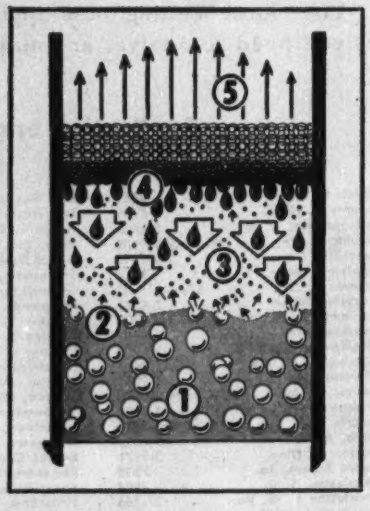
How These Pads Work



A gas generated in or passing through a liquid (1), carries with it, as it bursts from the liquid surface (2), a fine spray of liquid droplets. These entrained droplets are carried upward by the rising gas stream (3).

As this gas passes through the pad, the droplets impinge on the extensive wire surface (125 square feet per cubic foot of pad volume). Droplets accumulate on the wire surface and form large drops of liquid which break away (4) from the wire mesh and fall back against the gas stream. The gas (5) passes on, freed from liquid entrainment. The liquid is returned.

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1—#12 Sweetland Filter for 72 monel lvs., 2" C.C.; 1—#2, 23 cu lvs. 1½" C.C.
8—Shriver 42"x42", Iron Plate & Frame, 27, 54 chambers, 1" cake.
16—Sperry 18"x18", Iron, P & F, Filter Presses, close delivery, 11 chambers.
1—American Disc Filter 6' dia., 2 disc, 100 sq. ft. filtering area, with auxiliaries.
1—Shriver, iron, steam heated, 30"x30", 20 chambers, 1" cake.
1—8'x12' Oliver Lead-Wood Vacuum Filter Acid-Resisting.
3—Oliver Vacuum Filters, incl. 8x112', 11'6"x14', 11'6"x18'.
1—Sperry 24"x24" P & F Filter Press with 25 chambers, 2" frames.

VIBRATING SCREENS

1—Tyler Hummer 4'x10', 2 deck, with 2 vibrators and generator set.
1—Battery of two 3'x5', Tyler Hummer, Type 33, with Generator Set for both.
1—3'x8' Selectro, single deck.
1—3'x8' Selectro, double deck—rebuilt.
1—18"x5' Selectro—rebuilt.
1—Day Ro Ball Size 82, dbl deck, 40"x120".
1—Rotex, sgl. deck, 20"x48".

EVAPORATORS

1—Quadruple Effect Evaporator, calandria type, brass tubes, 14,000 sq. ft. H.S.; excellent condition; still erected; complete with piping, etc.
3—Mojonnier S/S Vac. Pans, 3', 4', 6', 8'.

DOUBLE DRUM DRYERS

1—42" x 120" Buflovak Atmospheric, S/S Conveyors, Elevator & Hood.
4—Buflovak Atmospheric—5' x 12', 32" x 90", 32" x 72".

DRY POWDER MIXERS

1—12,000# jac., horiz., Ribbon, Mixer.
1—Sturtevant 2000# Rotary; 1—Howes 1800# dbl. ribbon; 1—Munson Rotary 1000# batch; 1—Ransome ½ ton; 1—Readco Ribbon 700#; 2—Day 600# and 400#; 1—S.S. Rotary, 300#.

PEBBLE MILLS—LINED

1—Abbe 5' x 6', 10 H.P. motor.
2—5' x 4', 235 gal.
2—6' x 8', 800 gal.
4—Abbe, 125, 50, 25 gal.

PULVERIZERS

1—Williams 5-roll, high side.
3—Mikro Pulverizers, 2S1, 4TH.
1—6"x15" Sturtevant Jaw Crusher, to ½".
1—24"x15" Sturtevant Crushing Rolls, balanced type.
2—Raymond Screen Mills, #0A with Monel hammers, also 00.

HIGH SPEED MILLS

4—J. H. Day type B, 14" x 30", 3 roll High Speed Roller Mills, with all roller bearings and watercooled rolls—silent chain drive.

MISCELLANEOUS

3—Anderson Super Duo and Duo Expellers, M.D.
1—Patterson, 110 gal. S.S. Vacuum Mixer, dbl. sigma blades, M.D.
1—20 gal. jacketed, dbl. sigma bladed Baker Perkins Mixer, M.D.
2—Pneumatic Scale packaging lines.
3—B & J Rotary cutters; 1—#2; 1—#1, 15 H.P.; 1—Anti-friction bearings, 3 H.P.
2—Stainless horiz. 13,500 gal. welded Tanks, agitated.
3—Anco 4'x9' Chilling Rolls.
2—Buflovak 6' dia. Vacuum Crystallizers; 1—6' dia. Atmospheric, jacketed.
2—Dorr two-stage Classifiers, each with two rakes, total length 27', gear reducer and motor.
1—Davenport #3A Dewaterer.
1—Mechanical Cooker, 5' dia. x 16' long.

ROTARY KILNS & DRYERS

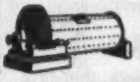
1—7'x60' Calciner, made by Struthers bearing supports, L-B gear reducer, with V-belted AC motor, firing hood, seal ring, with Vanderwerp-Manitowoc Recuperator, in excellent condition and priced for quick action.
1—7'6"x125'; 1—8'x135' Allis Chalmers; Rotary Kilns.
1—Vulcan 7'x120'; 2—Vulcan 8'x120'.
1—8'6" I.D. x 12' Rotary Nodulizer, ⅝" shell, Timken roller bearing rolls, gear reducer and motor drive.
2—3'x50' Rot. D.H. Dryers and Coolers.
4—Ruggles-Coles Direct Heat Rotary Dryers—Class XF4—54"x25', 1 Class XF 5'x40'. Three 3'x50'; 5'x30'; 5'x50'; 6'x40'; 6'x60'; 7'x70'.
6—Link Belt Roto-Louvre Dryers; #207-10 (2'7"x10'), #310-16, #503-10, #604-20, two #604-24.
2—6'x50' Louisville Rotary Steam Tube.
1—5'x33' Rotary Vacuum Dryer, jacketed Shell; 1—20"x8', jacketed, with dust collector and condenser.

JACKETED KETTLES

1—Patterson Fdry. 500 gal. steel, jacketed, closed, agitated Kettle.
36—S/S Jacketed Kettles, up to 1000 gal., some agitated.
17—S/S Vert. & Horiz. open and closed Storage Tanks, up to 2000 gal.
6—Dopp C.I. 80, 100, 150, 350, 600 gal.
7—Steel, agitated, 350, 500, 700, 800.
3—9500 gal., welded, agitated, open.
28—Aluminum and Copper, 30 gal. to 600 gal., some agitated.
1—400 gal. nickel jack, closed, with condenser and pump.

BARGAIN PRICES

4—Davine #28 Vacuum Shelf Dryers, each 20 shelves 59" x 78", surface condensers and vacuum pumps.
1—Tolhurst 48" steel basket Centrifugal, susp. type, bottom discharge.
4—Trayler Tube Mills, 5' x 22', 5' x 20', 4'6" x 18'6", 4' x 13', each stone-lined, scoop feed, pebble charge, clutch pulley.



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ROTARY-POSITIVE BLOWERS

MAKE	SIZE	TYPE	Max. Press.	Max. Cap.
Connersville	8 x 30	RS	1¼	600
Roots-Con.	36	AF	2	70
Roots-Con.	3	NS	2	76
Connersville	20 x 60	SF	2½	6040
Sutorbilt	2520	SD	3	16
Roots-Con.	22	XA	3	16
Sutorbilt	3L	SD	3	69
Roots-Con.	47	AF	3	124
Roots-Con.	89	AF	3	200
Roots-Con.	615	AF	3	366
Roots-Con.	717	AF	3	650
Connersville	10 x 15	SD	3½	890
Connersville	8 x 15	B	4	530
Roots-Con.	17B	XSB	5	40
Roots-Con.	55	XAS	5	96
Sutorbilt	3L	SD	6	31
Sutorbilt	4M	SD	6	76
Sutorbilt	5M	SD	6	115
Roots-Con.	22 x 36	HD	6	5500
Roots-Con.	53	AF	7	70
Connersville	10 x 12	HD	7	614
Sutorbilt	5H	XB	10	66
Sutorbilt	6H	XB	10	128
Roots-Con.	8 x 6	HD	10	215
Sutorbilt	10 x 11	HD	10	480

80 others in stock.

TURBO BLOWERS

MAKE	SIZE	H.P.	Volume c.f.m.	Static-oz.
Buffalo	4E	⅛	450	
Max-Premix	1	¼	95	1.69
Max-Premix	5	¼	200	2.3
N. American	3	1	34	3.50
Spencer	Belt drive		35	7.32
Spencer	50½	½	60	8
N. American	308-B1-½	½	100	8
Gen. Blower	890-¾	¾	180	8
West. Prod.	1	1	300	8
N. American	308-D12	2	575	8
N. American	308-D13	3	850	8
Eclipse Fuel	6815-½	7½	1100	9
Sturtevant	No. 2	1	215	10
Fisher Furn.	F-15	1	300	10
Fisher Furn.	F-20	2	390	10
Buffalo	40	5	750	10
Buffalo	6E	7½	1650	10
Spencer	075½	¾	60	12
Buffalo	5E	5	900	12
Gen. Blower	1601	1	100	16
Spencer	1002	2	225	16
N. American	316-C2-2	2	275	16
Spencer	1005	5	600	16
N. American	1716-G	5	675	16
Chgo. Blower	1607	7½	980	16
Spencer	1007-H	7½	1075	16
N. American	1716-H	7½	1100	16
Eclipse Fuel	6819-10	10	1200	16
Power Engrg.	2010	10	1120	20
Spencer	1203	3	335	20
Spencer	1215	15	1675	20
Ingersoll-Rd.	FS-377	85	10500	20
Ingersoll-Rd.	FS-377	150	15000	20
Ingersoll-Rd.	24C-223	3	270	24
Gen. Blower	2425	25	2500	24

60 others in stock

CENTRIFUGAL FANS

MAKE	SIZE	TYPE	Wheel Diam.	Inlet Diam.
New York	36	ME	36	39½
U. S. Air	36	B/C	36	37¼
Buffalo	6	LL	36½	37¼
American	6	HS	36	37¼
Thermo Ht Fan	60	MIH	37¼	36
Clarage	3	HV	39	40¾
U. S. Air	39	M	40	34
Bayley	7	B/C	38½	39¾
Sturtevant	8½	Des. 6	39¼	40¾
Bayley	8	I	40	41
American	6½	B/C	39¾	45⅞
American	7	HV	44	50½
Buffalo	8	CL	48	48
New York	49	ME	49	53¾
American	9	AHS	53¾	61

200 others in stock.

STEEL PLATE EXHAUSTERS

MAKE	TYPE	SIZE	Type Wheel	Wheel Diam.
American	E	35	Rim	23
Sturtevant	Des. 2	40	Rim	24
Bayley	SS	30	SS	25
Buffalo	SP	40	Rim	26
Sturtevant	Des. 2	35	SS	27
Garden City	SP	30	Cycloid	28
Cyclone B.P.	SS	40	SS	29
Sturtevant	Des. 2	45	SS	32
Sturtevant	Des. 1	55	Rim	33
American	E	55	Open	36
Clarage	IE	23	Open	36
Garden City	Cycloid	55	Cycloid	39
Sturtevant	SS	50	SS	40
Sturtevant	SS	55	SS	44
Buffalo	SS	50	Wool	45
Alington-Cur.	SS	60	SS	48
Buffalo	SS	70	Cotton	48
Alington-Cur.	SS	70	SS	56
Sturtevant	ME	70	SS	56
Alington-Cur.	SS	80	SS	64

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LOCOMOTIVE CRANE: Link Belt 25 ton capacity, standard R. R. gauge gasoline powered, cast steel trucks, air brakes, with or without 1¼ yd. Williams clam shell bucket, thoroughly modern, excellent condition. Located Minnesota.
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AIR SEPARATOR: Bradley 16 ft. with or without 100 H. P. motor.
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DRYERS—KILNS

3—Vulcan Kilns, 7'x160', 7'x10', ⅝" shell.
1—Vulcan 8'x120', ⅜" shell, two 12" tires complete.
2—Allis Chalmers 9'x80', ⅝" shell, 2—12" tires complete.
1—Ruggles-Coles 6'x50' Kiln, ½" shell.
1—5'6"x25', ½" shell, two 6" tires.
1—Louisville 38"x25' steel Hot Air Rotary Dryer.
4—Rotary Dryers 5'x67', 4'6"x50', 4'x30', 3'x25'.
2—Hersey 6'x23', 5'x23' Hot Air Rotary Dryers.
4—Louisville Steam Tube Dryers 6'x50', 6'x30', 5'x28', 3'x20'.
4—Buflovak single door vacuum shelf Dryers having 20—42"x42" shelves.
4—Devine single door vacuum shelf Dryers, having 20, 8, 6 and 4-40"x43" shelves.
5—Stokes & Buflovak Rotary Vacuum Dryers 30"x8', 3'x15', 6'6"x38'.
1—Single Drum 4'x9' Flaker.
2—Buflovak 6' Dia. Crystallizers.

FILTERS

3—Eimco 3'x1' S.S. Rotary-Vacs.
2—Oliver Monel 8'x10' Rotary-Vacs.
1—Oliver SS 8'x10' Rotary-Vac.
2—Eimco 4'x5' Rotary-Vacs complete with pumps, drives, piping, etc.
3—Oliver 5'3"x3', 3'x1' Rotary Vacuum Enclosed Precoat.
8—Oliver Rotary Vacuum 11'6"x18', 11'6" x14', 8'x12', 8'x10', 8'x8, 8'x6', 3'x1'.
1—Feinc steel 8'x12' Rotary-Vac.
2—Sweetland #12 with 72 and 36 leaves.
1—Sweetland #10 with 18 leaves.
1—Sweetland #7 with 27 leaves.
3—Vallez 500 sq. ft. Rotary Pressure.
1—Sperry 36" Recessed, 48 chambers, c.i., open delivery.
5—Shriver 30" P&F, 30 chambers, c.i., open delivery.
8—Sperry 24" P&F, 16 chambers, c.i., Closed delivery.
1—Shriver 24" Recessed, 30 chambers, c.i., open delivery.
3—Shriver 18" Recessed, 30 chambers, c.i., open delivery.
2—Sperry Aluminum 30" and 24" P&F, 22 and 26 chambers.
10—Shriver Sperry Filter Press Skeletons 42", 36", 30", 24", 18".

CENTRIFUGALS

2—NEW Tolhurst 48" center slung Stainless Steel, perforated baskets, motor driven.
1—Fletcher 48" Suspended Aluminum bottom discharge, perforated basket.
1—Fletcher 40" Suspended, SS, bottom discharge, perforated basket.
1—Tolhurst 32" Suspended Monel, bottom discharge, perforated.
1—Fletcher 30" Suspended Steel, bottom discharge, perforated.
1—Tolhurst 26" Suspended, steel, bottom discharge, perforated.
1—NEW Bird 36"x50" solid bowl, 317 Stainless Steel.
2—Bird 36"x50" solid bowl, rubber and stainless.
4—Bird 36"x72", 36"x50", 24"x38", 18"x 28" solid bowl continuous, steel.
3—Sharples #16P Monel & Stainless Steel Super Centrifuge.

LOOK!

3—Eimco 3' x 1' Rotary Vacuum Filters 3/16 Stainless Steel.
2—F. L. Smith 4' x 30', 4' x 25', Rotary Kilns, ½" shells, complete.
1—Link-Belt 6'4 x 24' Roto-Louvre Dryers 316 SS.
1—Link-Belt 3'10" x 14' steel Roto-Louvre Dryer.
1—Hersey 4' x 26' Monel Hot Air Rotary Dryer.
1—Hersey 3' x 24' Stainless Steel Hot Air Rotary Dryer.
1—Baker Perkins, Size 14, JEM double arm, jacketed Mixer, 50 HP motor.
1—Goslin Birmingham 4' x 8' solid nickel Flaker.
1—Link-Belt 2'7" x 8' Monel Roto-Louvre Dryer.
2—Milton Roy Duplex Proportioning Pumps, 212 GPH at 1500# pressure.
1—Baker Perkins 35 gal. stainless Steel, jacketed, double arm Mixer, Sigma Blades.
1—Day 50 gal. stainless steel jacketed, double arm Mixer, Sigma Blades.
4—Pfaudler New 500, 1000 gal. glass lined Reactors.
1—#2TH stainless steel Mikro Pulverizer.
2—Closed stainless steel Tanks 1500 and 1000 gal.
1—Hardinge 4½' x 16" Conical steel lined Ball Mill 30 HP.
1—Banbury #1A Mixer with 100/50 HP motor.
5—Heat Exchangers stainless steel shell and tubes 50 to 300 sq. ft.
2—Pfaudler 100 gal. glass-lined Stills with condensers and receivers.

PULVERIZERS

1—Bauer 36' Attrition Mill 2-50 HP mtrs.
8—Patterson 6'x8', 5'x6', 4'x5', 4'x4½' Pebble Mills.
5—Abbe 3'x4', 3'x3½' Pebble Mills.
2—Premier Colloid Mills 8" dia., SS.
1—Premier UB-6 Colloid Mill, Stainless Steel, 3 HP motor.
1—Jeffrey 36"x24", Hammer Mill.
3—Raymond, Gayco Mechanical Separators 14', 12', 4'.
2—Mikro No. 151, No. 1SH Pulverizers.
2—Sturtevant 5"x8" Roll Crushers.

SCREENS

5—Sprout Waldron SS, single deck, 40"x 84".
1—Day Ro-Ball single deck 40"x120".
3—Orville Simpson #42 Rotex Sifters 40"x84" screens.
4—Rotex #42, #22, and #11 single and double deck Screens.
1—Robinson double deck 20"x50".
5—Tyler Hummer 3'x5' triple deck.
6—Tyler Hummer 3'x15', 3'x10', 3'x5' single deck.
1—Abbe #2 Blutergess Sifter.
1—Selectro Double Deck 18"x48".

MIXERS

1—Baker Perkins JUMM jacketed, double arm, dispersion blades, 100 HP.
1—Baker-Perkins Type JNM, 100 gal. Sigma blade jacketed Mixer.
1—Baker Perkins, Type VI, Class BB, Size 15, 100 gallon double arm, Sigma Blades, jacketed.
1—Day 30 gal. Imperial, jacketed, double arm, sigma blades.
1—Patterson 5' dia. Conical steel.
1—Day 2000# steel Powder Mixer.
1—Robinson 4000# steel Powder Mixer.
6—Rodgers 200 to 3000# Powder Mixers.
8—New Portable Agitators ¼ to 5 HP.
4—Day, Ross 8 and 50 gal. Pony Mixers.

MISCELLANEOUS

1—Rodgers 10"x16" Jaw Crusher.
10—Bucket Elevators steel housing 34' to 60' centers, 8"x5", 10"x6" buckets.
1—Lummus 4' dia. steel bubble cap col.
4—Buflovak, Zaremba and Kilby Evaporators, single and multiple effect, 300 to 16,000 sq. ft.
7—Stokes Vacuum Pumps 15 to 100 CFM.
5—Devine, Buflovak, Condensers and Receivers, 20 to 90 sq. ft.
1—Newman 2500# Soap Crutcher.
4—Groen 150, 125 gal. stainless steel, jacketed, agitated Kettles.
8—Stokes DD2, BB2, D4, D3 and B2 Rotary Tablet Machines.
4—38" dia. stainless steel Revolving Pans.
3—Nash #TS12, AL671 and #4 Vacuum Pumps.
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BLENDER—310 cu. ft., jacketed.
CENTRIFUGE—40" Fletcher, SS.
CENTRIFUGE—40" Tolhurst, steel.
CLASSIFIER—Dorr, Duplex, DSFH.
COLUMN—6' x 49', 19 bubble cap trays.
COLUMN—6' x 44', 450 PSI.
COMPRESSOR—637 CFM, 125 PSI.
CONDENSER—Scraper, Aluminum.
CONVEYOR—Apron, 34' cc., 36".
CONVEYOR—Belt, 18" & 42".
CONVEYOR—Screw, 16" SS.
DIGESTER—3900 gal., jk'td. ASME.
DRYER—Conveyor, 24" x 28'9".
DRYER—Conveyor, 6'6" x 43", 4 belts.
DRYER—Drum, 5' x 6' Atmos.
DRYER—Drum, 24" x 20" SS.
DRYER—Roto-Louvre, 502-20.
DRYER—Vac., Stokes 59AB.
DRYER—Louisville, 6' x 35' steam tube.
ELEVATORS—Bucket, all sizes.
FILTER—Press, 36" CI 36 chambers.
FILTER—Vac., 8' x 12' Feinc.
FILTER—Rotary, 8' x 10' Oliver.
FILTER—Rotary, 11'6" x 18' Oliver.
FILTER—#12 Sweetland.
FURNACE—Rotary, Bruckner.
HEAT EXCHANGER—1035 sq. ft., 4 pass, 250 PSI.
HEAT EXCHANGER—5,740 sq. ft., chrome-moly.
KETTLE—400 gal. Pfaudler.
KILN—8' x 125' x ¾".
KILN—7' x 160' x ⅝".
KILN—604-24 SS Roto-Louvre.
KILN—502-20 Roto-Louvre.
KILN—4' x 30' x ⅜".
KILN—310-16 Roto-Louvre.
KOMBINATOR—Flowmaster K200, Stainless Steel.
MILLS—Ball, 6' x 8'.
MILL—Raymond, 50", 5 roll.
MIXER—L. B. 2' x 12', Pug.
MIXER—3900 gal., jacketed.
MIXER—Powder, 2190 cu. ft.
MIXER—Paddle, 140 cu. ft.
REACTOR—3000 gal., SS clad.
REBOILER—2200 sq. ft., 40 PSI.
SCREENS—4' x 10' Tyler.
STILL—Copper, 600 gal.
STILL—Cast iron, 1300 gal.
TANK—1300 gal. 5' x 9' x ¾" ASME, 250 PSI.
TANK—1350 gal., vert., 78" x 5' ASME.
TANK—12000 gal., 8' x 32'.
TANK—15000 gal., 10'6" x 23'.
TANK—16000 gal., 8' x 45', 150 PSI, ASME.
TANK—30000 gal., 10' x 47', 50 PSI, ASME.
TANK—135000 gal., 30' x 26'.

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MILLS, HARDINGE—Conical, 3'x8", 6'x22"/ Ball, 7'x36" Pebble, w/motors and drives.
MILLS, HAMMER—Wms. LG 1, Reg. #1, GA 80, Jeffrey 24x36 B-2 w/motors
SCREENS—Tyler Hummer 3x5, Single & triple, Sturtevant 3x8 single
SPENCER BLOWERS—475 cfm 32 oz. 1300 cfm 16 oz. with motors (unused)
ROTARY KILNS—5'x50', 6'x80', 8'x230'
COMPRESSOR—Nash Hytor, MD-873

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1—Eppenbach Stainless Steel Home Mixer, complete with a 7½ HP Explosion-Proof Motor.
1—Baker-Perkins 100 Gal. Stainless Steel Mixer, double-arm, sigma blades, with 20 hp explosion-proof motor.
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5—Pebble Mills 40 to 500 Gal.
10—Pony Mixers, 8, 15 and 40 gal.
HIGH SPEED Roller Mills 9"x24" to 18"x40".
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These units are self-supporting bases, motr. driven. Prices and further information on request.

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2 St. St. Packed Columns, 8" x 26" H and 24" x 6'8" H.
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1 Aluminum Bubble Cap Column, 27" dia. x 18 plate.
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1 Copper Column with 18—30" dia. perforated plates and 10—24" dia. bubble cap plates.

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15 Alum. Coil Exch. 47 sq. ft.
7 Copper tub. 20, 65, 90, 140, 1350 sq. ft.
8 S.S. tubular exchanger 14, 23, 55, 70, 100, 190, 368 & 400 sq. ft.
3 S.S. Coil Condensers, 40 sq. ft.

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1 Stokes #59A Jacketed Vacuum Rotary Dryer, 18" dia. x 42" long.
2 Atm. Double Drum Dryers, 22" x 38".
1 Buflovak Atm., Double Drum Dryer, 24" x 36".
1 Cummer Rotary Hot Air Dryer, 46" dia. x 26" long.

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1 Sweetland #10, 21 leaves, 3½" centers.
1 Sweetland #12, 72 leaves, 3½" centers.
1 Swenson Rotary Continuous Vacuum Filter: Precoat type, 8' dia. x 8' face, rubber covered and lead acid proof construction.
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1 Shriver 36" Filter Press, rubber covered, closed duty.
1 Shriver 36" C. I. P&F., 20 ch. cl. dty.
1 Louisville 8-roll Continuous Filter for Grains Press, 24".

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12—Horiz. Welded Steel Tanks, dished heads: 10,500, 11,300 and 12,700 gal.
1—4000 gal. Vertical Steel Cooker, Jktd., Agit.
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1—Sperry 24" C.I. Filter Press, 16 Ch.
1—Ammonia Compressor with motor; 10 x 10 (82 ton).
1—Steel Shell & Tube Condenser: 1000 sq. ft.
Lot of miscellaneous equipment—pumps, coolers, scales, kettles, tanks, bottling machinery, etc.

JUST PURCHASED

3—Stainless Steel Columns or Extraction Towers, 5' dia. x 50' high, baffle plate type.
3—Alsop T316 St. St. Filters, SD-12-NR-30.
5—Stainless Steel shell and tube heat exchangers: 55, 70 and 100 sq. ft.
1—Stokes RDS-3 Rotary Tablet Press, 15-hole, slotted head.
1—Baker-Perkins #14-JEM Universal Mixer, jacketed, vacuum cover; 50 gal. working cap.; 50 HP motor.
3—13 gal. Autoclaves T347 Stainless Steel, 700# int. WP; jacketed 50# WP.
3—Lightnin SEV-1500 Side Entering Mixers, Stainless Steel; 15 HP.
1—Stainless Steel T304 Horiz. Tank—16,000 gal. cap.
1—Stainless Steel Pressure Vessel, 600# WP, T304, 18" dia. x 9'4" L.

CHEMICAL PLANT

2—St. St. Jktd. Agit. Kettles, 450 gal.
3—St. St. Vacuum Tanks, 260 gal.
6—St. St. Tanks, 15, 100, 150, 200 gal.
1—St. St. Exchanger, 23 sq. ft.

KETTLES—REACTORS

1 Stainless Steel, Type 347 Autoclave or pressure tank, 250# pr., Elec. heated 850° F; 17¼ dia. x 9 high.
70 Stainless Steel and Stainless Clad open top, steam jacketed kettles—40, 60, 80, 100, 150, 500 gal. sizes.
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1 200 gal. Read Stainless Steel Jacketed Kettle, double motion agit., 10 HP.
4 Aluminum Reaction Kettles, Jktd. & Agit., 25, 80, 100 gal. and 250 gal.

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1 Paul Abbe #6 Pebble Mill, porcelain lined, 32" x 36".
1 Williams Hammer Mill, type AK; size A, stainless steel.
5 Mikro Pulverizers, #1-SH, #1-SI, #2-SI, #2-TH, #2-DH.
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5 Vertical Jacketed Pressure Tanks—Steel—30# steam jacket—6 mm. vacuum internally:
3—34" ID x 14' H (approx. 700 gal.)
1—23" ID x 10' H (approx. 230 gal.)
1—23" ID x 9' H (approx. 195 gal.)
8 15,000 gal. Vertical Welded Steel Closed Fermenting Tanks, 80 lbs. WP., turbine agitator with 40 HP motor; 970 lin. ft. 3" pipe coil. Excellent condition.

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1 16,000 gal. Horizontal.
1 5700 gal. Horiz. T304—NEW.
3 1000 gal. Rectang. open top.
50 Stainless Steel Tanks—from 9 gal. to 1000 gal. sizes.
5 3000 gal. Horizontal Stainless Steel Tanks, 5'4" dia. x 18'9" long, insulated and agitated. Excellent for transporting, storage or holding.

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5 DeLaval Centrifuges, models #600, 74-11 and 94-01.
2 Kux Machine Co. Model 25 Rotary Pellet Presses, 21 and 25 punch.
3 Stokes Rotary Pellet Presses, 16 punch, D-3.
4 Selectro Vibrating Screens, stainless steel, 2' x 7', double deck, enclosed.
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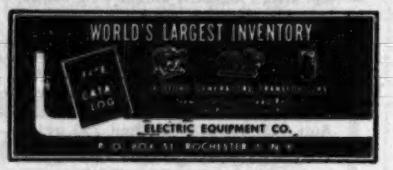

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1—Day Nickle Jack. & Vac. Double Arm Mixer—10 Gals.
6—Horiz. Spiral Mixers 200 to 2000#.

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6'x15' & 7'x17' Autoclaves.
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GYRATORY CRUSHERS—#3 up to #13. Also one 14", 16" & 42" Superior McCully gyratory crusher.
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2' x 80' Christie indirect heat rotary dryer, BV.
#222-#322-#636 A.-C. type B Hydrocone Crushers.
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3340—Brand NEW Stainless Steel Kettles good for 100# always in New York stock; sizes up to 500 gal. immediately.
3406—Stainless Clad 30 gal. steam jacketed Kettles; 40#.
3424 K9—Stainless 475 Gal. Kettle; Jktd. Agtd.; 4'x5'.
K7-151—Stainless 175 Gal. Cooling Kettle Jktd. 36"x 48", 2 way Agitator.
3662 D1—Creamery Pkg. Stainless Jacketed Pasteurizing Kettle; 40"x29".
3273—Pfaudler Glass Lined Jktd. & Agtd. Kettle 47"x67".
3444—Pfaudler Glass Lined Jktd. 350 Gal. Kettle 54"x36"; agitated.
3507—Special Lot of Copper Jacketed Kettles from 10 gal. to 250 gal.
3673 L5—250 Gal. Copper Jacketed Agitated (scraper type) Kettle.
K3-150—Dopp 150 Gal. Cast Iron Jacketed Kettle; 47½"x29¾".
3434—Dopp 650 Gal. Cast Iron Jacketed and Agitated Kettles.
3939—New Buflovak 500 Gal. Steel Jktd. & Agtd. Kettle; 4'x5'2".
K7-152—300 Gal. Cast Iron Fusion Pot; agitated; direct fired.
3218—3200 Gal. Steel Jacketed Closed Top Kettle; 9'6"x9'10½".
3247—Aluminum Steam Jacketed Kettles from 25 gal. to 250 gal.

REACTORS

3424 K4—Stainless Reactor; oil heated agitated; 24"x 48".
3561—Stainless Jktd. Agitated; 18"x24" with condenser.
3417—Stainless Jktd. Agitated Reactor; 24"x40".
3548—Stainless Jktd. Autoclave; 3000 PSI; Agitated; 10"x18".
3673 L9—Pfaudler Glass Lined Jktd. Reactor; 16"x 28".
3544—Pfaudler Glass Lined Jktd. Reactor; 4'x4'; 75 PSI.
3320—Stainless 250 Gal. Agitated Reactor; 36"x50".
3424 K2—Monel 250 Gal. Jktd. Agtd. Reactor; with Condenser and Accessories.
3670—Steel Reactor 4'x4' heated with copper coil unit.
3424 K9—Stainless 475 Gal. Reactor 4'x5' Jacketed and Agitated.
3168—Stainless 500 Gal. Jacketed Reactor; 6' dia. x 36" straight side.
3168 D7—Dopplop Jacketed Reactor; 40"x8' high.
3390—Buffalo 500 Gal. New Jktd. Agtd. Reactor; 4'x5'2" motorized.
3273—Pfaudler Glass Lined Jacketed, Agitated Reactor; 47"x67".
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★11 Stainless Steel Horizontal Tanks, 2,000- gal. capacity, with agitators.
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★12 Head Pneumatic Scale Vacuum Filler.
★ 2 Head Pneumatic Scale Automatic Capper.
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3566—Baker Perkins S/S Double Sigma Armst 12"x 6½"x10"; 2 HP XPL.
2940—Ross No. 2 Double Arm Mixer; 10"x12"x10" with 3 HP motor.
3533 E 3—J. H. Day No. 2; Jktd. 20 Gal. Double Army Mixer; 20¾"x16"x16".
2199—J. H. Day Jkt. Ribbon Mixer; 175 Gal. 28"x28"x 70".
2337—W. & P. Type Jktd. Double Arm 100 gal. Mixers, geared both ends.
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3427—Lancaster Model EAG4 Mix Muller, complete with all accessories.

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M14-29—Patterson Pore. Lined Pebble Mill; 3'0"x4'; direct drive.
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5' x 15' Rotary Kiln brick lined, complete.
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2—Ruggles Coles 7½'x60' & 6'x45' Rotary Dryers.
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1—Buffalo Vac. Drum Dryer 24" x 28".
6—Steam, Gas & Electric Dryers, Tray & Truck.
New Coco Rotary Dryers & Kilns, good deliveries.

CENTRIFUGALS & CENTRIFUGES

5—Tolhurst 40" Suspended Type Centrifugals. Bottom Discharge. Motor Driven.
6—Centrifugals 20", 30", 40", 42" & 48" Steel, Copper, Stainless & Rubber Lined.
12—Sharples Centrifuges #5A Stainless. Also #6.
5—De Laval Multiple Clarifiers #200, 300 & 301.

FILTERS

1—Vallez 41 Stainless Covered Leaf Filter, type 49.
10—Sperry & Shriver 12", 18", 24", 30", 36", Iron & Wood Filter Presses.
Sweetland & Oliver Rotary Vac. Filters.

KETTLES & TANKS

100 gal. Stainless Steel closed agit. Jack. Kettle.
2000 gal. type 304 Stainless Vert. Tank.
1—Depp 350 gal. Ci Jack. Vac. Kettle.
Devine 36" dia. Impreg. Unit. closed Jack-Liquor & Impreg. Kettles. Also 100 gal. size.
Devine 1000 gal. closed jack agit. steel kettle.
1—2300 gal. vert. agit. Jack Steel Kettle.
8—Jacketed Kettles 50 to 2500 gals.
1—250 gal. Lead Lined Kettle.
2—Pfaudler 500 gal. vert. Glass Lined Tanks.
New Stainless Steel Tanks 50 to 3000 gals.
50—Stainless Alum., Copper, Glass & Lead Lined Kettles & Tanks. Also new Stainless.
250 gal. vert. Copper Jack. Kettle.
6—Copper Varnish Kettles 150, 200 & 300 gals.

PULVERIZERS & MILLS

Patterson 6' x 8' & 6' x 5' Pebble Mills, motor dr.
Abbe 24" x 33" Pebble Mill. Also Jar Mills.
#1 Raymond Automatic Pulverizer 20 H.P. motor.
1—Raymond #00 Pulverizer 30 H.P. Complete.
1—#0000 Raymond Mills.
1—Hammer Mills & Pulverizers 3 to 50 H.P.
1—Schutz-O'Neill 20" Pulverizer. Also #1.

1—Sturtevant 30" Rock Emery Mill.
1—Robinson 22" Attrition Mill.
1—Lehman 4 Roll W. C. 12 x 36" Steel Mill.
5—Lehman & Kent 3 Roll Steel Mills.
8"x22", 9"x32", 12"x30", 16"x40".
1—9" x 36" Double Steel Roller Mill.
1—9" x 24" 3 pr. high steel Roller Mills.
3—Houchin 18 x 36", 4 Roll Granite Stone Mills.
4—Ball & Jewel & Lecminster Rotary Cutters.
2—U. S. & Premier 1½ H.P. Colloid Mills.

MIXERS & SCREENS

Baker-Perkins heavy duty double arm Mixers 100 50 & 9 gals. motor driven.
Horiz. Mixers single & double arm to 200 gal.
2—Day & Ross 15 gal. Pony Mixers.
1—Century 2 HP, 4 speed Vert. Mixer.
6—Lead & Paste Mixers 50 to 150 gals.
1—Tyler 3'x5' Vibratory 2 Deck Screen.
Patterson 42" dia. Stainless Conical Blender.
1—Master Drum Type Blender 1000#.
10—Dry Spiral Mixers 50 to 2500#.
12—Portable Elec. Agitators ¼ to 2 HP.

MISC. & SPECIAL

Stokes #280, 4" dia. Preform Machine.
Andersen RB Expeller 20 HP Motor Driven.
Sly Dust Collector, Bag Type, 242 sq. ft., complete.
2—Buffalo 6' dia. Vac. Crystallizers.
Gould 75 HP, Centrifugal Pump, 280 PSI.
4—French Oil Motor Driven Expellers.
New 6 x 12" Lab Mixing Mills and Calenders.
4—Farrell 2 Roll, Rubber & Plastic Mills.
3—Rubber & Plastic Extruders 1' to 6".
1—Stokes 2E Paste Filler up to 5 gal.
1—Elgin Capper ½ HP. Motor Driven.
1—Marco #200 Stainless Steel Homogenizer.
1—Stokes & Smith & Day Powder Fillers.
6—Filling Machines. Liquid Paste & Powder.
Rotary & Single Punch Tablet Machines, ½" to 3".
1—Howe Mogul Barrel Bag Packer.
2—Revolving Pans 30" & 36".
4—Stokes Vert. High Vac. Pumps.
2—Worthington 12" x 12" x 12" Vac. Pumps.
6—Devine & Buffalo Vac. Pumps.
Soap Machinery for Toilet Laundry Chip Liquid.
Plastic & Rubber Hydr. Presses, Extruders & Injection Molding Equipment.
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Boilers—Gas, Oil & Coal Fired.

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DRYERS

1—Roto Louvre 5x20' monel metal.
1—Devine No. 4-A Vacuum Shell.
2—Bonnot Rotary Kilns 6x50'.
3—Bonnot Rotary Kilns 5x45'.
1—4½x28' Rotary Direct Heat, oil.
1—7x45' Rotary Kiln, ½" shell.
1—6x32' Rotary—direct heat.
1—Kemp 400CFM Dynamic Dryer.
1—Davenport #3A bronze rotary Press.

Centrifugals and Clarifiers

1 set 3—36" American suspended (two with stain. steel perforate basket).
1—48" Tolhurst susp. steel perf.
1—40" Tolhurst suspended rubber covered perforate basket. Also 32".
2—De Laval 54-81 Clarifiers, 3 hp.
3—Sharples airtight Clarifier, stain. steel, 3 hp.

Evaporators and Vacuum Pans

1—New 36" Henszey st. steel Pan.
1—Rogers 42" st. steel.
1—20 gal. Stokes st. steel Vacuum Pan.
1—Swenson sgl. eff. Evap. 120 sq.ft.
1—Swenson quad. eff. Evap., 3500 sq.ft.
1—Zuromba trip. eff. Evap., 1500 sq.ft.
1—Swenson trip. eff. Evap., 850 sq.ft.

Filtration Equipment

1—Elmco rotary vacuum, st. steel.
12—Cast Iron recessed and plate and frame Filter Presses, 7" to 36".
1—Aluminum 30" 40-chamber P&F. press.
1—Lead 24" 38-chamber P&F. press.
1—Oliver 8x14' Filter.
1—Oliver pressure, iron, 110 sq.ft.
5—Alsop, Lemax internal pressure Filters, stain. steel and bronze.

MILLS

1—Prater No. 9DS, 50 hp.
3—Micro 5H, 15L, 4TH.
1—Attrition, Sprout-Waldron 20".
12—Pebble and Jar Mills, 1 to 235 gal.
5—Colloid Mills and Homogenizers, 3 to 15 hp.
10—Hammer Mills, ¾ to 50 hp.
2—Pot Mills, cast iron, 18 and 36".
6—3-roll Mills, Day, 12x32" and 16x40".
1—2-roll Rubber Mill, Birmingham, 12x24".

MIXERS

1—Abbe Lenart 10 and 110 gal.
1—Colton #6 s.s. Granulating.
1—Readco 250 gal. work. cap. stain. steel dbl. arm, 50 hp.
7—Baker-Perkins, Read, Lynn-Superior dbl. arm, 1 gal. to 100 gal.
2—Day 3000# jacketed horizontal ribbon.
10—Day, Robinson Powder type, 50 to 2000#.
3—2 hp. Alsop 1150 RPM. portable type.
6—Steel Mixing Tanks, 50 to 600 gal.

TANKS

30—Stainless Steel (some with agitators) new and used, up to 10,000 gal.
2—1000 gal. steel jacketed (100 psi.) open top.

MISCELLANEOUS

Screens: Rotex, Selectro, Tyler-Hummer.
Heat Exchanger: Karbate 16.5 sq.ft.
Vacuum Pumps: Stokes 105 CFM.
Sanitary Pumps: Waukesha size 55, 100.
Tablet Press: Stokes DD2 rotary.

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- Ruggles-Coles 90" x 60' Class XF14 Rot. Dryer
- Herschoff Roasting Furnace, 14 x 22'3" dia.
- Stearns-Rogers Calcine Coolers, 5' x 45 (3)
- Baker-Perkins Model S-24 Tor Mixer Cont. Cent.
- Sweetland #12 Filter, 36 lvs on 4" centers.
- Sweetland #12 Filter, 48 lvs on 3" centers
- Fletcher 40" Centrifugal. 15 HP, solid steel
- Proctor-Schwartz Apron Dryer, S.S. 8' x 90'
- Sharples PY-14 Super-D-Canter S.S. New
- Baker-Perkins Core Sand Mixer, size 16½DM
- Rotex #52 double deck Screen, 60" x 120"
- Pfaudler 300 Gal. S.S. Reactor, Jckt. & Agit
- Elmco 8' x 8' rotary Cont. Filter. Complete
- Oliver 5'4" x 8' Precoat Filter. All iron
- Simpson #2 Mixmuller, Style V.D. 25 HP
- Abbe-Lenart 220 gal. liquid Mixer. 30 HP
- Oliver-Dorrco Filters, 14' x 18' (2)
- Akins Classifiers, 54" x 36' long. Recond (3)
- Dorr Thickener Mechanism 100' diameter
- Dings Mag. Separator, Dual-boards 6-30" rolls
- Vulcan Briquetting Press, 10-12 TPH cap.
- Double ribbon Mixer, 60 cu. ft. mix capacity
- Rietz RD-18 Disintegrator, 50 HP
- Raymond #1 Imp Mill. Complete with motor
- Karbate Exchanger, 178-1½" tubes 566 sq. ft.
- Sperry 36" C.I. Filter, 20 plts & frms
- Sperry 36" C.I. Filter, 50 recessed plates
- Moore 4' x 5' Ball Mill, 15 HP Ex proof
- 3—100 gal Stainless Kettles, 100# W.P.

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Fitzpatrick Model D S/S Mill
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Bufflovak Double Drum Dryer 32"x100" Complete. Prater Mill Included.
Bufflovak Double Drum Dryer—32"x52" Complete. Mill Included.
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Mikro 2TH Pulverizer
Mikro 1SH Pulverizer.
Filter Presses 12"x30" P&F or Recessed.
In Stock At All Times: New & Used Kettles 2½ to 1000 gallon. S/S or Plain Steel.
Robinson Model J Gardner Type Mixer. 29 cu. ft. Cap.
Abbe Lenart Mixer—3 gallon capacity. S/S Jacketed w/motor.
Abbe Lenart Mixer—110 gallon capacity. S/S Jacketed. w/motor.
2—6000# Ribbon Mixers—Jacketed.
Portable Agitators w/new motors.
Additional Mixers in stock.—Ribbon & Sigma Blades. Laboratory to 5 ton sizes.
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1—1" Waukesha Sanitary Pump with 1 H.P. motor 140/220V.
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4—1/3 H.P., 420 RPM, Mixer Motors
1—F-M Weigh Scale, 1000 Lb. Cap.
3—3 Ft. S.S. Kettle with top & 1½" Drain
1—30 In. S.S. Kettle with top & 1½" Drain
2—4 Ft. Sq. x 18" Deep S.S. Tank with Steel Legs, 1" Inlet & Drain
1—2 Ft. Diam. x 2 Ft. Deep S.S. Tank with Sight Glass
2—1 Ft. Diam. x 30 In. Deep S.S. Tank with Sight Glass
2—3 Ft. x 22 In. High Flat Bottom S.S. Tank with Cover
1—30" D. x 42" H. Open Top Steel Tank with 2" Drain

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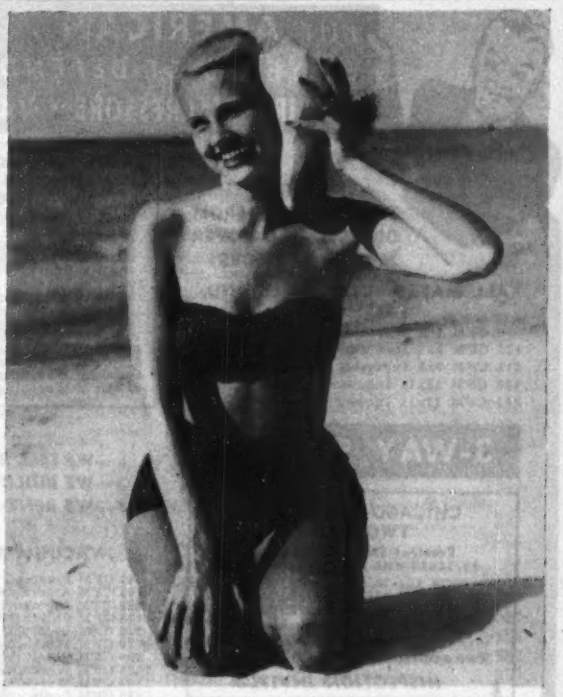
2—Oliver Rotary Vacuum Filters, 5'3" x 6', Steel Construction with Monel Screens.
1—Oliver Homogenous Lead Filter, 8' x 8'.
1—Sperry Aluminum Plate & Frame Filter Press, 42" x 42", Closed Delivery, 3" Frames, 35 Chambers.
1—Pfaudler 100 Gal. Glass Lined Jacketed Vacuum Distillation Unit with Stainless Steel 60 Sq. Ft. Condenser and Stainless Steel Receiver.
1—Pfaudler Glass Lined Storage Tank, 1000 Gals.
1—Pfaudler Glass Lined Jacketed Vacuum Reactor, 500 Gals.
1—Pfaudler Glass Lined Jacketed Kettle with Anchor Type Agitator, 150 Gals.
1—Glascote 1600 Gal. Glass Lined Jacketed Vacuum Kettle
3—Day #30 Imperial Jacketed Double Arm, Sigma Blade Mixers, 75 Gal. Working Capacity.
1—Link Belt Stainless Steel Roto-Louvre Dryer, #310-16.



THE GELB GIRL—AUGUST, 1953

DRYERS—KILNS

1—Vulcan Rotary Kiln, 7'x120'.
7—Devine Vacuum Shelf Dryers, 5 & 9 Shelves.
1—Buflovak Double Drum Dryers, 32"x90".
1—Louisville Steam Tube Dryer, 6'x50'.
2—Buflovak Vacuum Drum Dryers, 24"x20".
1—Devine Rotary Vacuum Dryer, 5'x25'.
2—Buflovak Double Door Vacuum Shelf Dryers, 20 shelves each.

FILTERS

2—Oliver Steel Filters, 5'3"x6'.
1—Shriver Stainless Steel Filter Press, 24"x 24", Closed Delivery, 10 Chambers.
3—Shriver 24"x24" Aluminum Plate & Frame Filter Presses, Closed Delivery, 35 Chambers each.
1—Sperry 42" C I Plate & Frame Filter Press, 18 Chambers, Closed Delivery.
1—Sperry 12" Bronze Plate & Frame Filter Press, Closed Delivery, 9 Chambers.
1—Shriver 42" Evedur P&F Filter Press, 40 Chambers. Closed Delivery.
3—Shriver 36"x36" C I P&F Filter Presses, Closed Delivery, 24 & 25 Chambers.
5—Sweetland Filters, #2, 5, 7 and 12.
1—Oliver Rotary Steel Filter 3'x1'.
1—Shriver 24"x24" cast iron, closed delivery, filter presses, 3 eye, 23 chambers.
2—Sperry C I closed delivery Filter Presses, 24"x24", 30 chambers.

CENTRIFUGALS

1—Fletcher Stainless Steel Suspended Type Centrifuge, 40" Perforated Basket.
2—A. T. & M. S S Susp. Centrifuges, 48" Imperforated Baskets.
1—Fletcher 40" Centrifuges, Bronze Perforated Basket with Motor.
1—Tolhurst Stainless Steel Suspended Type Centrifuge, 40" Imperforated Basket.
1—Fletcher 48" Centrifuge, Bronze Perforated Basket, Motor.
1—Sharples Stainless Steel Super D Canter, Model PN-14.
6—Sharples #16-Y Stainless Steel Super Clarifying Centrifuges.

MIXERS

1—Baker Perkins S.S. Jacketed Double Arm Mixer, Sigma Blade, 9 gal.
3—Baker Perkins Steel Jacketed Mixers, 200 gal. Working Cap., Sigma Blades.
1—Nettco Drive, Model WT 27, output speed 16.
1—Banbury Mixer #1.
1—Simpson #1 Intensive Mixer.
4—Baker Perkins Steel Jacketed Mixers, Sigma Blades, 100 Gals.
3—Baker Perkins Stainless Steel, Jacketed Mixers, Sigma Blades, 100 Gals.
3—Turbo Steel Jack. Mixers, 700 Gals. Each.
12—Simpson #0 Intensive Mixers "Unused".
1—Readco Stainless Steel Jacketed Double Arm Jacketed Mixer, Sigma Blades, 225 Gals.
1—Baker Perkins Stainless Steel Dispersion Mixer, Size 15, Type VUMM, 100 gals. working cap., 150 gals. total cap., 75 HP Drive.

PULVERIZERS—GRINDERS—MILLS

1—Mikro #2TH Stainless Steel Pulverizer.
1—Premier Stainless Steel Colloid Mill, Model UB-6.
1—Stewart Bolling 2-Roll Mill, 6"x12".
1—Mikro #3TH Mikro Pulverizer with 30 HP Motor.
1—Mikro #3W Pulverizer.
1—Mikro #2TH Pulverizer, Stainless Steel & Bronze Construction, with Motor.
1—Abbe #2 Master Rotary Cutter.
1—Ball & Jewell #0 S.S. Rotary Cutter.
2—Ball & Jewell #2 Rotary Cutters.
1—Blaw Knox Air Mill Pulverizer.
1—Mikro Stainless Steel Atomizer #6.
3—Thropp 2-Roll Rubber Mills, 10"x50".
1—Abbe #2 Buhrstone lined Pebble Mill, 5'x4'.
1—Gruendler #24-40 Hammer Mill.
1—Thropp 2-Roll Rubber Mill, 10"x24".
1—Sprout Waldron #36 Attrition Mill with 2-75 HP Motors.

AUTOCLAVES—KETTLES—TANKS

2—Glascote Glass Lined Jacketed Kettles, 10 & 20 Gals.
1—Pfaudler Glass Lined Jacketed Kettle, 20 Gals.
1—Monel Storage Tank, 1,300 Gals.
2—Blaw Knox Steel Jacketed Autoclaves, 300 & 500 Gals. Cap., P.S.I. Working Pressure 500 Lbs.
4—Buflovak Vacuum Shelf Dryers, 20 Shelves Each.
1—Buflovak Type 347 Stainless Steel Rotary Vacuum Dryer, 5' x 20' with all auxiliary equipment.
1—Bird 24" Monel Screen Type Centrifugal Filter.
1—Baker Perkins Stainless Steel Jacketed Double Arm Mixer, Sigma Blade, 9 Gal.
1—Combustion Engineering Stainless Steel Jacketed Autoclave, 300 Gal., 300 PSI.
1—Sweetland #2 Stainless Steel Filter, 12-16" Leaves, 28 Sq. Ft.

1—Patterson Steel Jacketed Autoclave, 800 Gals. Cap., Internal Pressure 120 Lbs.
1—Artesian Steel Jacketed Kettle, 1,000 Gals. Cap., with Rake Type Agitator, ASME Code, 50 Lbs. Pressure.
2—J. P. Devine Jacketed Vacuum Reactors, 2,000 Gals. Cap. Each.
1—Buffalo Steel Pressure Tank, 10,000 Gals. Cap. 125 PSI, ASME Coded.
25—Steel Storage Tanks, 9,000-17,500 Gals.
1—Steel Rubber Lined Storage Tank, 4,500 Gals. Cap.

MISCELLANEOUS

3—Downington Stainless Steel Heat Exchangers, 45 & 500 sq. ft.
1—Struthers Wells Hastelloy B Heat Exchangers, 450 sq. ft. "Unused".
1—Worthington Worthite Pump, with 7½ HP Motor, Model #3CT1A.
3—Nash Hytor Vacuum Pumps, Model #TS-12.
1—Ambaco Model 3A Heavy Duty Horizontal Continuous Baler.
1—Vulcan Copper Condenser, 300 sq. ft.
1—Dayton Dowd Centrifugal Pump, Stainless Steel, Size 1C8, 35 GPM at 40' head, speed 1745 RPM, 2"x1".
2—Worthington Antactron Centrifugal Pumps, Model #3 CU1, 4"x3".

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60 CFM Worthington (Gas) 2 Pneu
70 CFM Smith (Gas) 2 Pneu
105 CFM Ingersoll (Gas) 4 Pneu
105 CFM Worthington (Gas) 2 Pneu
105 CFM Worthington (Gas) 4 Pneu
160 CFM Worthington (Gas) 2 Pneu
160 CFM Worthington (Gas) 4 Pneu
210 CFM Worthington (Gas) 4 Pneu
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800 CFM Worthington 18x9
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SEWAREN, NEW JERSEY

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#316 Stainless Steel Tanks, new, 100, 200 & 260 gal.
1—Stainless Tank #430 Chrome, vert., 7'x10' deep.
20—Jacketed Kettles—Stainless, Copper, Aluminum.
1—Day mixer, Steam Jacketed, 50 gal. Sigma Blade.
1—Robbins Vibrex 3x6 Vibrating Screen, single deck.
1—Copper Evaporator, steam jacketed, 9'4"x3'9".
60—New Pressure Cookers, 16"x18" & 24"x28".
50—Pumps—steam and electric.
1—New Glass Nash Centrifugal Pump, 100 gpm.
1—Jeffrey Vibrating Conveyor 15' lg. 12" wide.
1—Buflovak Jacketed Impregnating Tank 42"x52".
1—4x8 Sturtevant Jaw Crusher.
3—Copp Kettles with Agitators, 700 gal. Cap.
3—Tankcar Tanks 10,000 gal. each, with coils.
2—Large Steam Jacketed Horizontal Mixers.
1—Ribbon type Mixer, steam jacketed.
1—Model 16 Sharples Stainless Steel Centrifuge.
3—New Drum Rollers.
1—A. F. Bartlett Nox Mill & 7½ H.P. Motor.
10—Tanks, 9'6"x30'—15,500 gal. each.
3—Stainless Steel Jacketed Filters.
1—Gaulin Stainless Steel Homogenizer, Type CGC, 125 gph, with 5 H.P. 3 phase motor—like new.
1—Shriver 18" Aluminum Filter 9-plates, 9-frames.
4—Stokes Rotary Tablet Machines RD4.
10—New Sharples Oil Purifiers.
3—3000 gal. Jacketed Kettles with Turbo Agitators.
1—Patterson Ball Mill, Steam Jacketed, 36"x42".
1—Patterson Ball Mill, porcelain lined, 17"x27".

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Powder mixers 50 to 2000 pounds
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Buflovak Dbl. Drum atmospheric Dryer 42x100
Pfaudler 10 gal. jacketed glass lined reactor w/ agitation
Laughlin Horiz. Continuous Filter
S. S. Tanks 50 to 2000 gal. agitation avail.
Boilers 2 h.p. to 500 h.p. Oil or Gas Fired
Mikro Pulverizer 4-TH with extra screens
Lehman 5-roll Mill 12" x 36" water cooled
Tolhurst 48" Centrifuge
J. H. Day Roball Sifter size 81, screen 40" x 120"
La Bour Acid Pumps
Proctor and Schwartz 84 tray dryer, and 5, 40 trays
Portable Electric Liquid Mixers 1/3 to 3 h.p.

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One 3000 KW General Electric rotary converter, 250 DC volts, 13000 DC amperes, 6 phase 60 cycle, 300 RPM, with 13.8 KV transformer and AC and DC switchgear.

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Chemical Engineering Reader Service

• CHEMICALS • EQUIPMENT • SERVICES

How Reader Service Works

The Reader Service postcard inside the back cover makes it easy to get more information on any of the chemicals, equipment or services listed here. The card has corresponding numbers for each of the key page numbers in this directory. Circle the numbers of the items you want; fill out the return address; mail the card to us. Answers will come direct to you from the companies. The letters, L, R, T, B, locate ads on the page: left, right, top, bottom. The letters a, b, c and A, B, C indicate first, second, third, etc., item in an ad or on a particular page.

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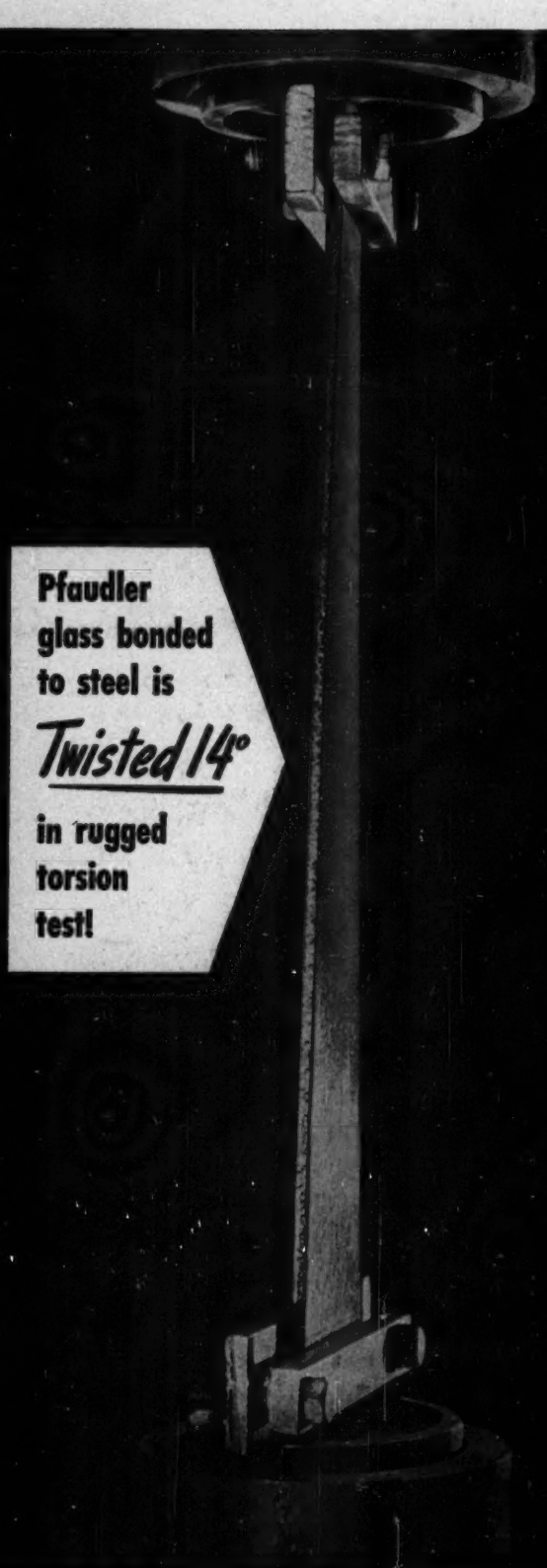

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